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ABSTRACT

This curriculum guide for a vocational agriculture course in farm equipment mechanics addresses the three domains of learning (psychomotor, cognitive, and affective) while providing job-relevant tasks and suggestions for specific classroom activities for each identified task. This guide provides performance objectives for the following 13 tasks: assembling equipment; performing administrative functions; servicing bearings and seals; servicing conveyance systems; servicing hydraulics; servicing carburetion and fuel systems; servicing cooling and lubrication systems; servicing electrical systems; servicing internal combustion engines; servicing tires; servicing mechanical components of balers; servicing mechanical components of planters. For each duty, the guide provides a number of performance objectives, related to task; standard performance of task; source of standard; conditions for performance of task; enabling objectives; resources; teaching activities; criterion-referenced measures; answers; practical application; method of evaluating practical application; and checklists. Appendixes provide a cross-reference table, explanation of symbols, definitions, equipment by percentage rating, sources of standards, a list of state-of-the art literature, and a 36-item bibliography. (KC)

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V-TECS GUIDE
FOR
FARM EQUIPMENT MECHANIC

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INTRODUCTION

A V-TECS Guide is an extension or a continuation of one or more V-TECS Catalogs. The V-TECS Catalog is a composition of duties, tasks, performance objectives, and performance guides which deal with the psychomotor aspect of an occupation. The catalog can be considered the blueprint of an occupation.

The catalog serves as the foundation for the V-TECS Guide. Experience has shown that the art of learning can be taught while teaching subject matter. A V-TECS Guide provides an efficient method for this process. The Guide addresses the three domains of learning: psychomotor, cognitive, and affective. The following is a brief explanation of each.

Psychomotor

Manipulative skills, such as sharpening a pencil and making a bulletin board display, are representative of activities that are psychomotor in nature. These tasks are identified in a catalog and grouped by duties and objectives. Each performance objective has a performance standard which must be met to demonstrate student proficiency in the manipulative aspect of the task.

Cognitive

Cognition is the mental process by which knowledge is acquired. To perform psychomotor tasks, students must think. Effective thinking is necessary for successful performance of job tasks. Students gain cognition through real and vicarious experiences. This guide enables the instructor to provide decision-making opportunities for students, thus developing their cognitive skills.

Affective

The affective domain deals with attitudes, interests, and values development. Desirable behavior is the learning outcome of the affective domain. This guide presents activities created to promote an understanding of self and others in a working environment. The instructor is encouraged to use the activities to stress how attitudes, values, and goal attainment influence working relationships and productivity.

USE OF V-TECS GUIDE

A V-TECS Guide is designed to provide job-relevant tasks, performance objectives, performance guides, resources, teaching activities, evaluation standards, and criterion-referenced measures. It may be used with any teaching method the instructor chooses. Although a guide contains suggestions for specific classroom activities for each identified task, teachers are encouraged to be creative in adapting the material to meet the particular needs of their students.

ASSEMBLING EQUIPMENT

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 1

TASK

Assemble primary tillage equipment.

STANDARD OF PERFORMANCE OF TASK

Tillage equipment must perform soil preparation designed to perform as specified in operator's manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Primary tillage equipment
Assembly manual
Operator's manual
Mechanic's tool set
Tape measure
Tractor
3/4" Drive socket set

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 303-14, 317-29.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 303-14, 317-29.
2. List uses of primary tillage equipment.
3. Describe the types of primary tillage equipment.
4. Demonstrate how to apply proper torque to fasteners.
5. Explain the safe assembly of hydraulic components.
6. Identify lubricants to be applied to operating components.
7. Discuss the different types of hitches.
8. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 1

CRITERION-REFERENCED MEASURE

Questions

1. Which of these machines are used for primary tillage?

   a. plows
   b. listers and bedders
   c. rotary tillers
   d. all of the above

2. A __________ wrench is used to assure proper tightening of fasteners.

3. __________ are used to support equipment being assembled, adjusted or repaired.

Answers

1. d
2. torque
3. Jack (or machine) stands

Practical Application

Have students assemble primary tillage equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 1 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 1

ASSEMBLING PRIMARY TILLAGE EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inventoried parts. Cut away bindings and packing crates.		
2. Read assembly manual, noted all safety precautions. Cleaned components as necessary.		
3. Assembled frame according to assembly instructions.		
4. Hitched frame to tractor and lift.		
5. Assembled and attached lower parts.		
6. Made all adjustments as specified in operator's manual.		
7. Tightened all bolts using torque specifications given in assembly manual.		
8. Lubricated as specified in operator's manual.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 2

TASK

Assemble secondary tillage equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled, this equipment must provide preparations in accordance with specification in operator's manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled secondary tillage equipment
Operator's manual
Assembly manual
Mechanic's tool set
3/4" Drive socket set
Grease guns
Means of lifting and supporting frame

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 303, 314-35.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 303, 314-35.
2. List uses of secondary tillage equipment.
3. Describe the types of secondary tillage equipment.
4. Explain the importance of using jack stands.
5. Sketch and describe the purpose of elevating the tractor.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 2

CRITERION-REFERENCED MEASURE

Questions

1. Which of the following practices are necessary in preparing to assemble a new machine?
   a. Locate the model and serial number of the machine.
   b. Obtain assembly and operator's manual.
   c. Position main frame at proper height on machinery supports.
   d. Level main frame with carpenter's level.
   e. All the above.

2. All secondary tillage equipment can be classed in three groups, which are: ________, ________, ________.

3. When making adjustments of tillage machinery it is necessary to
   a. place the tractor in reverse.
   b. check the power steering fluid level.
   c. elevate the tractor by placing blocks under the wheels.
   d. check the water/coolant level.

Answers

1. e
2. disk harrows, cultivators, rotary tillers
3. c

Practical Application

Have students assemble secondary tillage equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 2 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 2

ASSEMBLING SECONDARY TILLAGE EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Inventoried parts and cut away all bindings.		
2. Read assembly manual, noted all safety precautions. Cleaned components as necessary.		
3. Assembled frame in accordance with assembly manual.		
4. Raised assembled frame.		
5. Assembled and installed gauges in order given in assembly manual.		
6. Installed any accessories to be used.		
7. Tightened all bolts to torques given in assembly manual.		
8. Lubricated at points specified in operator's manual.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 3

TASK

Assemble planting equipment.

STANDARD OF PERFORMANCE OF TASK

Planter must plant seed at regular intervals and at depths consistent to needs of crops being planted as prescribed in operator's manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Planter needing assembly
Operator's manual
Assembly manual
Mechanic's tool set
10' Tape measure
Grease gun

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 336-54.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 336-54.
2. List the types of planting equipment.
3. Describe uses of various planting equipment.
4. Explain the sequence of operation of various planting equipment.
5. Discuss planting depths of various seeds.
6. Compare sprocket size to number and spacing of seeds dropped.
7. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 3

CRITERION-REFERENCED MEASURE

Questions

1. The two classifications of planting equipment are _____ and _____.
2. The sprocket size is determined by ______________________________.
3. Tire inflation can affect the _________ of the planter.

Answers

1. row-crop planters, grain drills
2. the number of teeth
3. seed/acre output or calibration

Practical Application

Have students assemble planting equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 3 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 3

ASSEMBLING PLANTING EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inventoried parts. Removed bindings and packing crates.		
2. Read instruction manual and noted all safety precautions. Cleaned components as required.		
3. Assembled frame. Installed hitch to tool bar.		
4. Attached frame or tool bar to tractor for lifting while attaching planting assembly.		
5. Assembled planter as specified in assembly manual.		
6. Attached planter to frame or tool bar at desired row spacing.		
7. Installed desired accessories.		
8. Calibrated seed drop mechanisms.		
9. Lubricated as prescribed in operator's manual.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 4

TASK

Assemble cultivation and weed control equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled, equipment must provide operator with means of weed control when used according to operator's manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled cultivation or weed equipment
Operator's manual
Assembly manual
Mechanic's tool set
10' Tape measure
3/4" Drive socket set
Grease gun
Tractor capable of lifting cultivator

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 316-23, 333-35.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 316-23, 333-35.
2. List the types of cultivation and weed control equipment.
3. Describe the uses of various cultivation and weed control equipment.
4. Discuss how adjustment affects crop yield.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 4

CRITERION-REFERENCED MEASURE

Questions

1. At what depth is a field cultivator designed to operate?
2. Setup and adjustment of a row-crop cultivator is determined by ____________________.
3. For row-crop cultivation the tractor tires should be adjusted to ____________ the row spacing.

Answers

1. approximately four inches
2. the maturity and growth characteristics of the plant's root system
3. twice

Practical Application

Have students assemble cultivation and weed control equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 4 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 4

ASSEMBLING CULTIVATION AND WEED CONTROL EQUIPMENT

Student's Name ____________ Date ____________

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inventoried parts and cut away all bindings.		
2. Read assembly manual, noted all safety precautions.		
3. Assembled frame or attached hitch if tool bar was used.		
4. Attached to tractor.		
5. Installed sub-assemblies as detailed in assembly manual.		
6. Tightened all bolts to torque specifications given in assembly manual.		
7. Lubricated as specified in operator's manual.		

APPROVED: YES ____ NO ____

Evaluator's Signature ____________ Date ____________

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 5

TASK

Assemble fertilizing equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled, equipment must provide means by which operator can apply fertilizer in metered amount within specified area(s).

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled fertilizer equipment
Mechanic's tool set
Grease gun
Operator's manual
Assembly manual

ENABLING OBJECTIVE

1. Read and interpret assembly and operator's manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 371-72.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 371-72.
2. Discuss the uses of various fertilizing equipment.
3. Explain the differences in calibrating band applicators and drill applicators.
4. Explain the differences in banded broadcast and row crop calibration.
5. Demonstrate the conversion of application rates.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 5

CRITERION-REFERENCED MEASURE

Questions

1. Rates of dry granular fertilizer can be expressed in ______________.
2. Why do dry granular fertilizer hoppers require cleaning?
3. Name two implements generally equipped with granular fertilizer: ____________ and ____________.

Answers

1. pounds/acre
2. helps to prevent rust and corrosion from developing
3. grain drills, row planters

Practical Application

Have students assemble fertilizing equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 5 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 5

ASSEMBLING FERTILIZING EQUIPMENT

Student's Name _______________________ Date _______________

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inventoried all parts.		
2. Read assembly manual and noted all safety precautions. Cleaned components as necessary.		
3. Assembled frame assembly.		
4. Assembled fertilizer hoppers and attached to frame.		
5. Assembled and installed drive force.		
6. Attached spouts.		
7. Lubricated at points given in operator's manual.		

APPROVED: YES _____ NO _____

Evaluator's Signature _______________________ Date _______________

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 6

TASK

Assemble corn harvesting equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled and adjusted according to manufacturer's specifications, equipment must provide operator with means by which corn can be harvested safely.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Harvesting equipment in need of assembly
Mechanic's tool set
Operator's manual
Assembly manual
Lubricating equipment

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 404

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery,** page 404.
2. List the types of corn harvesting equipment.
3. Discuss how harvesting machinery saves time and money.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 6

CRITERION-REFERENCED MEASURE

Questions

1. Corn picker heads can be
   - a. PTO driven pull-type units.
   - b. mounted on a self-propelled combine.
   - c. both a and b.
   - d. none of the above.
2. Do corn picker heads shell the corn? (Yes or No)
3. Can corn in the dough stage be harvested with a corn head? (Yes or No)

Answers

1. c
2. no
3. no

Practical Application

Have students assemble corn harvesting equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 6 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 6

ASSEMBLING CORN HARVESTING EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Inventoried all parts.		
2. Read assembly manual and noted all safety precautions. Cleaned components as necessary.		
3. Assembled frame as described in assembly manual.		
4. Installed and adjusted snapping units and filled gear boxes with lubricants.		
5. Installed means by which machine is to be driven.		
6. Adjusted and lubricated as prescribed in operator's manual.		
7. Installed guards and sheet metal.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 7

TASK

Assemble forage harvesting equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled, forage harvesting equipment must provide means of cutting and chopping forage within limits set by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled forage harvester
Assembly manual
Operator's manual
Mechanic's tool set
Necessary lubrication equipment

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manuals.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 396-401.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 396-401.
2. List the different types of forage produced.
3. Describe the different types of forage harvesting equipment.
4. Have students conduct research on forage harvesting over the past 50 years.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 7

CRITERION-REFERENCED MEASURE

Questions

1. List three types of forage gathered for todays livestock: ______________, ______________, ______________.
2. ______________ is succulent feed that undergoes partial fermentation while stored in silos.
3. ________ ________ are harvested and fed directly to livestock.

Answers

1. silage, green chops, stover
2. Silage
3. Green chops

Practical Application

Have students assemble forage harvesting equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 7 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 7

ASSEMBLING FORAGE HARVESTING EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Inventoried parts and cut away all bindings.		
2. Read assembly manual, noted all safety precautions. Cleaned components as necessary.		
3. Assembled as directed in assembly manual.		
4. Adjusted cut to desired length.		
5. Lubricated as specified in operator's manual.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 8

TASK

Assemble grain harvesting equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled equipment must provide operator with a safe and efficient means of harvesting grain(s) within limits determined by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled grain harvesting equipment
Operator's manual
Assembly manual
Mechanic's tool set
Lubricating equipment

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manuals.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 402-13.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 402-13.
2. Have students conduct research on grain harvesting equipment over the past 50 years.
3. Discuss how new techniques of grain harvesting have made farmers more efficient.
4. Describe types of grain harvesting equipment.
5. Describe the operation of grain harvesting equipment.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 8

CRITERION-REFERENCED MEASURE

Questions

1 __________ are the major grain harvesting units.

2. Repairs to running equipment ______ be conducted.

3. Combine ________ can determine profit or loss.

Answers

1. Combines
2. should not
3. adjustments

Practical Application

Have students assemble grain harvesting equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 8 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 8

ASSEMBLING GRAIN HARVESTING EQUIPMENT

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inventoried all parts.		
2. Read assembly manual and noted all safety precautions. Cleaned components as necessary.		
3. Followed procedures as set down in assembly manual.		
4. Made needed adjustments.		
5. Lubricated as described in operator's manual.		
6. Operated machine and tested all moveable parts.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 9

TASK

Assemble hay harvesting equipment.

STANDARD OF PERFORMANCE OF TASK

After assembly, equipment must perform functions for which designed within limits set by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled hay harvesting equipment
Mechanic's tool set
Hydraulic jack
Assembly manual
Operator's manual
Grease gun

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manuals.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 377-95.

TEACHING ACTIVITIES

1. Have students to read and discuss textbook, **Agricultural Power and Machinery**, pages 377-95.
2. Describe the types of hay harvesting equipment.
3. Discuss the type of materials for which hay harvesting equipment is best suited.
4. Explain hay harvesting equipment operations to students.
5. Identify safe operational techniques of hay harvesting equipment.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 9

CRITERION-REFERENCED MEASURE

Questions

1. ________ is the number one hay crop in the United States.
2. ________ and ________ are useful in reducing labor required to harvest, handle, and feed hay.
3. Most balers are powered by ________.

Answers

1. Alfalfa
2. Large round balers, stack wagons
3. the PTO unit of a matching tractor.

Practical Application

Have students assemble hay harvesting equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 9 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 9

ASSEMBLING HAY HARVESTING EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Unpacked and inventoried all parts.		
2. Read assembly manual. Noted all safety precautions. Cleaned components as necessary.		
3. Installed hitch.		
4. Installed wheels, if used.		
5. Assembled drive shaft assembly.		
6. Installed mechanism which contacts hay.		
7. Installed windrow attachments, if used.		
8. Lubricated as directed in operator's manual.		
9. Installed all shields and tightened.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 10

TASK

Assemble crop processing equipment.

STANDARD OF PERFORMANCE OF TASK

When assembled, equipment must perform duty for which designed within limits set by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Unassembled processing equipment
Assembly manual
Operator's manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manuals.
2. Identify basic tools.

RESOURCE

Hunt. **Farm Power and Machinery Management**, 7th edition, pp. 176-91.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Farm Power and Machinery Management**, pages 176-91.
2. List the types of crop processing equipment.
3. Explain the need of safe operational procedures.
4. Discuss the uses of crop processing equipment.
5. Describe the operational procedures of crop processing equipment.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 10

CRITERION-REFERENCED MEASURE

Questions

1. Crop processing equipment can be classified as being either _____ or _____.
2. The two major types of crop processing equipment are _____ or _____.
3. Crop reducing equipment can be
    a. hammer mills.
    b. roller mills.
    c. cutter mills.
    d. attrition mills.
    e. all the above.

Answers

1. stationary, portable
2. reducing equipment, drying equipment
3. e

Practical Application

Have students assemble crop processing equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 10 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 10

ASSEMBLING CROP PROCESSING EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Inventoried all parts.		
2. Read assembly manual and noted all safety precautions. Cleaned components as necessary.		
3. Followed all assembly procedures in order given in assembly manual.		
4. Assembly was completed and lubricated as described in operator's manual.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY ASSEMBLING EQUIPMENT

PERFORMANCE OBJECTIVE 11

TASK

Assemble front loader equipment.

STANDARD OF PERFORMANCE OF TASK

Loaders must perform all functions listed in operator's manual with no damage to loader.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Front loader
Tractor
Operator's manual
Assembly manual
Grease gun
Specified hydraulic fluid
Mechanic's tool set
10' Tape measure
Lift or hoist
3/4" Drive socket set

ENABLING OBJECTIVES

1. Read and interpret assembly and operator's manuals.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 153-79.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 153-79.
2. List operating principles of hydrostatic power.
3. Show students the types of hydraulic components used in agricultural machinery.
4. Have students draw a schematic of a hydraulic system. (e.g. tractor, peach harvester, etc.)
5. Demonstrate safe inspection for leaks on a hydraulic system.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 11

CRITERION-REFERENCED MEASURE

Questions

1. Hydraulics have _______ manual lifting of heavy objects.
2. _______ _______ states that when pressure is developed on a fluid it acts equally in all directions.
3. A cylinder which is moved by a fluid in both directions is known as a _____________ cylinder.

Answers

1. reduced
2. Pascal's law
3. double-acting

Practical Application

Have students assemble front loader equipment to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 11 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 11

ASSEMBLING FRONT LOADER EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inventoried parts. Removed all bindings and shipping crates.		
2. Read assembly manual and noted all safety precautions. Cleaned components as necessary.		
3. Prepared tractor for assembly as prescribed in assembly manual (if loader hydraulic pump mounting is needed, did so).		
4. Assembled loader frame and mounting brackets.		
5. Lifted frame with suitable lift or hoist and placed on tractor mounting brackets.		
6. Attached loader. Tightened bolts.		
7. Connected lines and installed control valve.		
8. Filled with fluid and lubricated all points prescribed in operator's manual.		
9. Tested loader for proper performance.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

PERFORMING ADMINISTRATIVE FUNCTIONS

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 12

TASK

Assign jobs.

STANDARD OF PERFORMANCE OF TASK

Job must be assigned so assignee understands fully and performs the job and/or jobs specified.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Job to assign
Someone to whom job is assigned
Pencil/pen
Paper and/or work order forms

ENABLING OBJECTIVES

1. Identify employee limitations.
2. Identify individual differences.
3. Identify general job descriptions.

RESOURCES

1. Christenson, Johnson and Stinson. **Supervising**, pp. 302-03.
2. George. **Supervision in Action (The Art of Managing Others)**, 4th Edition, pp. 51-59.

TEACHING ACTIVITIES

1. Explain that each employee has differences.
2. Have students discuss differences of employees.
3. Discuss how each person should be considered.
4. Show that behavior is natural.
5. Have students explain loyalty and how it is involved in performing a job.
6. Explain how jobs should be assigned to different individuals.

PERFORMANCE OBJECTIVE 12

CRITERION-REFERENCED MEASURE

Practical Application

Have students assign jobs.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 12 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 12

ASSIGNING JOBS

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Determined staff mechanic availability and determined qualifications to match requirements of work orders.		
2. Ranked urgency of repair work done.		
3. Completed a work order giving full detailed instructions on job performed.		
4. Communicated written orders including all information needed to complete job.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 13

TASK

Complete initial service data on invoice.

STANDARD OF PERFORMANCE OF TASK

Initial information on service invoice must be completed, giving all parts and materials used, all time spent doing repairs and complete customer identification.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Invoice
Completed work order
Pencil/pen

ENABLING OBJECTIVES

1. Write legibly.
2. Identify components of service invoice.

RESOURCES

1. A sample service invoice.
2. A sample of needed customer identification data.

TEACHING ACTIVITIES

1. Explain the parts of a sales slip.
2. Discuss how to use a sales tax table.
3. Discuss how and where to record the item being purchased.
4. Discuss how to record the cost of an item.
5. Explain how to record on the sales slip if a discount is applicable.
6. Discuss how to record the labor cost.
7. Have students list the quantity on a sales slip.
8. Have students complete the description.
9. Have students complete the labor cost on a sales slip.
10. Have students compute the sales tax.
11. Have students add the sales tax and the cost of the item.

PERFORMANCE OBJECTIVE 13

CRITERION-REFERENCED MEASURE

Practical Application

Have students complete initial service data on an invoice.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 13 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 13

COMPLETING INITIAL SERVICE DATA ON INVOICE

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Filled in invoice completely from completed work order.		
2. Listed all jobs performed from completed work order.		
3. Listed time spent doing each job from completed work order.		
4. Listed all parts and material used on repair job from completed work order.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 14

TASK

Complete service invoice.

STANDARD OF PERFORMANCE OF TASK

Invoice must be completed with 100% accuracy showing total price for all parts, material, and labor combined.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Invoice with initial service data completed
Parts price book(s)
Pencil/pen

ENABLING OBJECTIVES

1. Explain the meaning of expense.
2. Identify different types of expenses.
3. Figure a two place decimal calculation.

RESOURCES

1. Huffman and Stewart. **General Recordkeeping**, pp. 184-307.
2. A sample sales tax table.

TEACHING ACTIVITIES

1. List expenses on board.
2. Separate expenses into groups. (operating, wages, parts, equipment, and miscellaneous)
3. Discuss cost of various expenses.
4. Explain the difference between wholesale and retail.
5. Demonstrate calculating the total of a group of expenses.
6. Show how to compare expenses with revenue.
7. Show how to calculate sales tax using a sales tax table.

PERFORMANCE OBJECTIVE 14

CRITERION-REFERENCED MEASURE

Practical Application

Have students complete a service invoice.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 14 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 14

COMPLETING A SERVICE INVOICE

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Looked up parts and material prices in parts price book and recorded on invoice.		
2. Computed labor cost and recorded on invoice.		
3. Totaled parts and labor figures and recorded on invoice.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 15

TASK

Complete work order.

STANDARD OF PERFORMANCE OF TASK

Work order must be completed with 100% accuracy, listing all parts and materials including quantity, time spent doing repair work and equipment I.D. numbers.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Work order having detailed instructions of work to be performed
Pencil/pen
Service manual
Parts manual
Clock
Piece of equipment/machinery

ENABLING OBJECTIVES

1. Identify machine information (manufacturer number and make).
2. Read and interpret a service manual.
3. Read and interpret a flat rate manual.
4. Read and interpret a parts catalog.
5. Identify listings on the order form.

RESOURCES

1. A parts catalog
2. A flat rate manual

TEACHING ACTIVITIES

1. Demonstrate how and where to list all owner and machine identification information.
2. Have students complete the owner and machine identification information.
3. Discuss how to determine if the work order is an estimate or warranty work order and how to list properly.
4. Demonstrate how to determine what service needs to be performed.
5. Discuss where on a work order form to list servicing or repairing.
6. Discuss parts that will be used and how to identify in a parts catalog.
7. Show where to list parts used.

PERFORMANCE OBJECTIVE 15

Teaching Activities (Continued)

8. Explain the amount of time it might take to do the job . Refer to a flat rate manual and a clock.
9. Show where to place amount of time used to repair/service on the work order form.

CRITERION-REFERENCED MEASURE

Practical Application

Have students complete a work order.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 15 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 15

COMPLETING A WORK ORDER

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Recorded time work started.		
2. Recorded all machine identification numbers.		
3. Looked up all necessary parts and material for repair work to be done.		
4. Listed all necessary parts and material by quantity.		
5. Recorded time work completed.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 16

TASK

Prepare written cost estimate of repair work for customer.

STANDARD OF PERFORMANCE OF TASK

Cost estimate must comply with shop policies, reflect accepted pricing standards and include complete cost of needed repair.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Piece of equipment needing repair
Service manual
Parts manual
Price list
Test and cleaning equipment
Pencil/pen
Paper
Repair Order

ENABLING OBJECTIVES

1. Explain the meaning of expense.
2. Identify different types of expenses.
3. Figure a two place decimal calculation.
4. Explain the meaning of estimate.

RESOURCE

Huffman and Stewart. **General Recordkeeping**, pp. 184-207.

TEACHING ACTIVITIES

1. List expenses on board.
2. Separate expenses into groups. (operating, wages, parts, equipment, and miscellaneous)
3. Discuss cost of various expenses.
4. Explain the difference between wholesale and retail.
5. Demonstrate calculating the total of a group of expenses.
6. Show how to compare expenses with revenue.
7. Show how to write estimate for customer.

PERFORMANCE OBJECTIVE 16

CRITERION-REFERENCED MEASURE

Practical Application

Have students prepare a written cost estimate of repair work for a customer.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 16 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 16

PREPARING A WRITTEN COST ESTIMATE OF REPAIR WORK FOR A CUSTOMER

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Cleaned and removed all parts as was necessary to reach repair area.		
2. Tested and/or inspected visually area repaired.		
3. Located parts and/or materials through parts catalog search.		
4. Recorded part numbers and materials on work order form.		
5. Located parts and/or material prices from parts price book.		
6. Recorded parts and/or material prices on work order form.		
7. Determined labor cost.		
8. Recorded labor price(s) on work order form.		
9. Totaled parts and/or materials and labor prices.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 17

TASK

Interview customer to obtain description of problem.

STANDARD OF PERFORMANCE OF TASK

The interview must result in identification of all problem areas.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Customer having a problem with a piece of equipment
Paper
Pencil/pen
A sample service order form

ENABLING OBJECTIVES

1. Identify equipment information (manufacturer number and make).
2. Read and interpret a service manual.
3. Read and interpret a flat rate manual.

RESOURCES

1. A parts catalog
2. A flat rate manual

TEACHING ACTIVITIES

1. Demonstrate how to listen to customer complaints and/or problems.
2. Have students listen and interpret common problems of customers.
3. Discuss how to determine if the work order is an estimate or warranty work order and how to list properly.
4. Demonstrate how to determine what service and/or repairs need to be performed.
5. Discuss where on a work order form to list servicing or repairing.
6. Discuss parts that will be used and how to identify in a parts catalog.
7. Explain the amount of time it might take to do the job. Refer to a flat rate manual and a clock.
8. Explain and show students the claim check part of the work order form, why it is necessary, and what to do with it.

PERFORMANCE OBJECTIVE 17

CRITERION-REFERENCED MEASURE

Practical Application

Have students interview a customer to obtain description of a problem.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 17 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 17

INTERVIEWING A CUSTOMER TO OBTAIN THE DESCRIPTION OF A PROBLEM

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Determined the manufacturer and model of equipment having a problem.		
2. Questioned customer for machine application (what it was being used for at time problem occurred).		
3. Questioned customer for operational description (how machine was operating prior to problem and after problem occurred).		
4. Provided written description of stated problem.		
5. Sought agreement of customer with stated problem.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 18

TASK

Obtain in-stock repair parts through catalog search.

STANDARD OF PERFORMANCE OF TASK

Parts obtained must have serial and model numbers which match the original part and must be appropriate for the area of the equipment on which it is to be used.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Model
Serial number of a piece of equipment needing parts
Parts catalog
Pencil/pen
Forms

ENABLING OBJECTIVES

1. Follow instructions.
2. Identify model number from equipment.
3. Identify type number from equipment.
4. Identify parts in a catalog.
5. Identify part number from a parts catalog.

RESOURCES

1. Purchase Requisition, South Carolina Department of Youth Services.
2. A parts catalog

TEACHING ACTIVITIES

1. Describe how to read and find a part number in a parts catalog.
2. Discuss where to find model and type number on equipment.
3. Demonstrate completing a request form.
4. Discuss importance of completing form correctly.
5. Have students demonstrate completing a request form.

PERFORMANCE OBJECTIVE 18

CRITERION-REFERENCED MEASURE

Practical Application

Have students obtain in-stock repair parts through catalog search.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 18 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 18

OBTAINING IN-STOCK REPAIR PARTS THROUGH CATALOG SEARCH

Student's Name **Date**

DIRECTIONS TO STUDENT Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Determined correct parts catalog by using model and serial numbers for equipment parts.		
2. Looked in index for area parts obtained for (i.e. carburetor, clutch, transmission).		
3. Looked on appropriate page and located part(s) needed.		
4. Listed part(s) numbers on form used to obtain parts from parts sources.		
5. Presented form to parts source.		
6. Received parts from parts source.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY PERFORMING ADMINISTRATIVE FUNCTIONS

PERFORMANCE OBJECTIVE 20

TASK

Prepare warranty claims.

STANDARD OF PERFORMANCE OF TASK

Warranty claim must be completed with 100% accuracy.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Warranty claim needing to be prepared
Pencil/pen
Customer information
Dealer information
Equipment information
Sample warranty claim form

ENABLING OBJECTIVES

1. State how to use a calculator.
2. Follow instructions.
3. Identify correct forms.

RESOURCE

Warranty Claim Report, Gravely Tractor Company, Columbia, S. C.

TEACHING ACTIVITIES

1. Discuss the importance of reading the warranty card.
2. Explain information needed to complete a warranty claim report.
3. Review a sample claim report.
4. Demonstrate completing warranty claim report.
5. Have students complete a sample warranty claim report.

PERFORMANCE OBJECTIVE 20

CRITERION-REFERENCED MEASURE

Practical Application

Have students prepare warranty claims.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 20 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 20

PREPARING WARRANTY CLAIMS

Student's Name **Date**

DIRECTIONS TO STUDENT — Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Checked manufacturer's warranty guidelines.		
2. Completed all customer information.		
3. Completed equipment identification section, model and serial number.		
4. Completed delivery date section.		
5. Completed date of repair section.		
6. Completed cause of failure section.		
7. Completed type of failure section.		
8. Completed description of failure section.		
9. Recorded parts used for warranty repair from work order.		
10. Recorded labor time from work order.		
11. Recorded any labor for removing mounted attachments.		
12. Recorded labor for cleaning.		
13. Recorded other credits.		
14. Signed and dated.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

SERVICING BEARINGS AND SEALS

DUTY SERVICING BEARINGS AND SEALS

PERFORMANCE OBJECTIVE 21

TASK

Realign shaft and bearings.

STANDARD OF PERFORMANCE OF TASK

The shaft must operate efficiently without excessive noise, or rough operation.

SOURCE OF STANDARD

Fundamentals of Machine Operation -- Combine Harvesting, pp. 16-17.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
A shaft with adjustable bearings
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 322-23.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 322-23.
2. Discuss the importance of proper shaft/bearing alignment.
3. Have students list agricultural equipment requiring shaft/bearing alignment.
4. Using the service manual, list maintenance schedule for shaft/bearing checks.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 21

CRITERION-REFERENCED MEASURE

Questions

1. Improper bearing/shaft alignment results in ________ life of both bearing and shaft.
2. Shaft life is dependent on _____ _____.
3. Bearing _______ is a result of misalignment.

Answers

1. reduced
2. proper alignment
3. failure

Practical Application

Have students realign shaft and bearings.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 21 to determine if the assignment was completed for competency.

REALIGNING SHAFT AND BEARINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted technical or service manual for specifications. Cleaned components as necessary.		
2. Inspected shaft for damage that would have prevented adjustment.		
3. Loosened locking collars and mounting brackets.		
4. Checked shaft for warpage.		
5. Tightened locking collars in opposite direction of shaft rotation.		
6. Checked flanges for security.		
7. Adjusted brackets in line and tightened.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING BEARINGS AND SEALS

PERFORMANCE OBJECTIVE 22

TASK

Replace bearings.

STANDARD OF PERFORMANCE OF TASK

Bearings must be lubricated and must fit in accordance with manufacturer's specifications.

SOURCE OF STANDARD

Fundamentals of Machine Operation -- Combine Harvesting, p. 37.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Bearings needing to be replaced
New parts
Service manual
Grease

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 133-34, 230.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 133-34, 230.
2. Describe the types of bearings used in agricultural machinery.
3. List methods of removing and installing a bearing.
4. Demonstrate packing of bearing.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 22

CRITERION-REFERENCED MEASURE

Questions

1. Bearings used in agricultural machinery are classified as _______ and _______ types
2. The three types of antifriction bearings are _______, _______, and _______.
3. Ball bearings are used in agricultural machinery because they can carry both _______ and _______ loads.

Answers

1. plain bearings (or bushings), antifriction
2. ball, roller, needle
3. radial, thrust

Practical Application

Have students replace bearings.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 22 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 22

REPLACING BEARINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted technical or service manual for procedures.		
2. Cleaned the bearing housing, shaft, and retainer.		
3. Using press, puller or hammer, removed the bearing.		
4. Cleaned and inspected bearing, if reused.		
5. Cleaned and inspected shaft and housing, and replaced if necessary.		
6. Lubricated bearing.		
7. Reinstalled bearing, placing constant pressure on outer race giving direct support (inner or outer).		
8. Replaced retainer and rechecked adjustment.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING BEARING AND SEALS

PERFORMANCE OBJECTIVE 23

TASK

Replace dynamic seals.

STANDARD OF PERFORMANCE OF TASK

The system must not leak lubricant following seal replacement and must function according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Special tools
Service manual
New seals
A unit requiring new seals

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 229-30, 134-35.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 229-30, 134-45.
2. List examples of dynamic seal usage.
3. Describe the functions of dynamic seals.
4. Demonstrate proper removal and installation of dynamic seals.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 23

CRITERION-REFERENCED MEASURE

Questions

1. It is recommended that dynamic seals be replaced _________ bearings are packed.
   a. each time
   b. when needed
   c. never
   d. every third time
2. A shaft, requiring a seal, with sharp edges may have a _________ end to prevent seal damage.
3. ___________ seals are used to prevent leakage from an exposed shaft.

Answers

1. a
2. tapered
3. Dynamic

Practical Application

Have students replace dynamic seals.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 23 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 23

REPLACING DYNAMIC SEALS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for procedures.		
2. Cleaned area and removed any obstructions to the seal.		
3. Removed seal with appropriate tool.		
4. Checked for causes of leakage.		
5. Checked seal for damage or failure.		
6. Checked shafts and bores at seal contact areas.		
7. Cleaned the shaft and bore area.		
8. Installed seal with lip toward the lubricant to be retained.		
9. With appropriate tool, pressed or drove the seal carefully into its place.		
10. Checked for damage.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

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DUTY SERVICING BEARINGS AND SEALS

PERFORMANCE OBJECTIVE 24

TASK

Replace plain bearings (bushings).

STANDARD OF PERFORMANCE OF TASK

After replacement, the bushing must function within allowable clearance with no damage to the bearing shaft or bore.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Plastigage
Mechanic's tool set
New bearings
Special driver or puller
Service manual
Assembly needing new bearing

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 282-85.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 282-85.
2. Describe the many uses of plain bearings or bushings.
3. Have students list equipment owned or operated having plain bearings.
4. Demonstrate the use of Plastigage in determining bearing running clearance.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 24

CRITERION-REFERENCED MEASURE

Questions

1. __________ is used to determine bearing running clearance.
2. Plain bearings or bushings must have adequate ________ if expected to last normal life.
3. __________ __________ can be either one-piece or two-piece styles, depending on application.

Answers

1. Plastigage
2. lubrication
3. Plain bearings

Practical Application

Have students replace plain bearings (bushings).

Method of Evaluating Practical Application

Use Checklist For Performance Objective 24 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 24

REPLACING PLAIN BEARING (BUSHINGS)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed any obstructions.		
3. Cleaned area and components as necessary.		
4. Removed bearing with driver or puller.		
5. Inspected shaft and bore.		
6. Cleaned or replaced shaft and bore.		
7. Installed new bearing with driver.		
8. Checked for damage and fit.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING BEARING AND SEALS

PERFORMANCE OBJECTIVE 25

TASK

Replace static seals.

STANDARD OF PERFORMANCE OF TASK

The seal must be impermeable to fluids when compressed through variable temperatures and pressures, and resist deterioration.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
New seals
Object needing new seals

ENABLING OBJECTIVES

1. Identify basic tools.
2. Read and interpret service manual.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 130, 134.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 130, 134.
2. Discuss where static seals are used.
3. Describe the function of static seals.
4. List types of static seals.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 25

CRITERION-REFERENCED MEASURE

Questions

1. Seals prevent the loss of _________ from bearings and gears.
2. Seals prevent _________ _________ from entering the working parts.
3. Care should be taken not to _________ seals during installation.

Answers

1. lubricant
2. abrasive dirt
3. damage

Practical Application

Have students replace static seals.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 25 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 25

REPLACING STATIC SEALS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed parts to obtain access to joint.		
3. Separated objects being sealed.		
4. Inspected and cleaned sealed surface.		
5. Applied sealant as required.		
6. Checked proper position of seal.		
7. Installed seal.		
8. Rejoined objects being sealed.		
9. Tightened to specifications.		
10. Checked for damage.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING BEARING AND SEALS

PERFORMANCE OBJECTIVE 26

TASK

Adjust bearings.

STANDARD OF PERFORMANCE OF TASK

Adjustment of the bearing must be to its most efficient tension allowing no end play, drag, or damage.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Bearing needing adjustment

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 230.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 230.
2. Describe procedures used to adjust bearings.
3. Explain the necessity of proper bearing adjustment.
4. Have students list equipment having adjustable bearings.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 26

CRITERION-REFERENCED MEASURE

Questions

1. Two methods of adjusting bearings are _____ and _____.
2. The outside nut containing slots is called a ________.
3. If the bearing is adjusted too tight, bearing _______ occurs.

Answers

1. torquing sequence, by feel
2. spindle castle nut
3. failure

Practical Application

Have students adjust bearings.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 26 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 26

ADJUSTING BEARINGS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Checked that stationary surface is correct.		
3. Loosened or tightened retainer as necessary.		
4. Rotated shaft or hub and checked for drag.		
5. Checked for end play or slip.		
6. Locked safety retainer.		
7. Reinstalled cover or guards.		
8. Checked lubrication.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

SERVICING CONVEYANCE SYSTEMS

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 27

TASK

Adjust chains.

STANDARD OF PERFORMANCE OF TASK

The chain must operate smoothly with freedom from noise and binding.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Conveyance system
Mechanic's tool set
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCES

1. Hunt. **Farm Power and Machinery Management**, 7th edition. pp. 194-96.
2. John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, p. 41.
3. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 143-47.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Farm Power and Machinery Management**, pages 194-96.
2. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, page 41.
3. List the uses of flight conveyors.
4. Describe the various types of flight conveyors and compare their advantages or disadvantages.
5. Explain the need for shutting off the power source from a safety stand point.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 27

CRITERION-REFERENCED MEASURE

Questions

1. Flight conveyors are basically those having _____ as the carrying mechanism.
2. Cost of flight conveyor is directly proportional to its ________.
3. The capacity of a flight conveyor can be estimated by knowing the following: ________, ________, ________, and ________.
4. Chain sag should be ______ inch(es) per foot between shaft centers (with one side of chain taut) on horizontal and inclined drives.

Answers

1. chains
2. length
3. dimensions of flight, chain speeds, flight spacing, angle of the conveyer with the horizontal
4. one-quarter (1/4)

Practical Application

Have students adjust chains to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 27 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 27

ADJUSTING CHAINS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service manual.		
2. With machine stopped, removed shields from chains and sprockets, if necessary.		
3. Loosened chain idler pulley or sprocket and adjusted tension of chain.		
4. If this did not prove satisfactory, removed one or more links from the chain. Referred to the service manual for specific instructions for that particular type of chain.		
5. After removal of links, readjusted the idler and tightened to manufacturer's specification.		
6. Replaced all guards and shields and test ran the machine.		
7. Checked for freedom of movement and noise.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 28

TASK

Adjust belts.

STANDARD OF PERFORMANCE OF TASK

The unit must operate smoothly with no slippage, no excessive noise, and freedom from binding.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Conveyance system
Mechanic's tools set
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCES

1. John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, pp. 53-54.
2. John Deere and Co. **Fundamentals of Service . . . Power Trains**, pp. 10-4, 10-5.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, pages 53-54.
2. Discuss the importance of proper belt tension.
3. Identify techniques of adjusting belts.
4. Have students list the difference between belt squeak and belt squeal.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 28

CRITERION-REFERENCED MEASURE

Questions

1. Too ________ tension will cause slippage.
2. Belt tension can be checked by _____ and/or _____.
3. The machine should be ____________ when adjusting belts.
   a. idling
   b. in neutral
   c. accelerating
   d. shut-off

Answers

1. little
2. spring scale and ruler or straight edge and ruler
3. d

Practical Application

Have students adjust belts.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 28 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 28

ADJUSTING BELTS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed guards and shields to gain access to belts.		
3. Adjusted belt tension by adjusting the position of the idler or by sliding the motor forward or backward to tighten or loosen the belt.		
4. Checked the tension by using a belt gauge or ruler.		
5. Readjusted if necessary.		
6. Replaced all guards and shields and test ran.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 29

TASK

Align chain and sprocket.

STANDARD OF PERFORMANCE OF TASK

Chains must not bind when machine is operating.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, p. 145.
2. John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, p. 37.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 145.
2. Explain what would happen if shafts were not parallel and/or level.
3. Describe the necessity of sprocket alignment.
4. Demonstrate proper chain and sprocket alignment.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 29

CRITERION-REFERENCED MEASURE

Questions

1. Sprocket shafts must be _____ and _____ with one another.
2. A _____ _____ is used to level shafts.
3. A _____ _____ is used to align sprockets.

Answers

1. level, parallel
2. machinist's level
3. straight edge

Practical Application

Have students align chain and sprocket to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 29 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 29

ALIGNING CHAIN AND SPROCKET

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted the service manual for specifications.		
2. Removed shields and guards to gain access to chain sprocket.		
3. Released chain tension.		
4. Loosened lock bolts holding chain sprocket stationary on its shaft and slid sprocket in either direction until it came into correct alignment with chain and other sprocket. Checked alignment by using a straight edge between the two sprockets or by measuring from a reference point.		
5. Tightened sprocket lock bolt and retightened chain.		
6. Tested machine and observed operation for noise and binding.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 30

TASK

Clean and lubricate chain.

STANDARD OF PERFORMANCE OF TASK

Chains must be free from foreign materials such as dirt, straw and grease and must operate smoothly without excessive noise.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Conveyance systems
Wire brush
Specified lubricant
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . Belts and Chains**, pp. 42-44.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, pages 42-44.
2. Explain why periodic inspection and cleaning are necessary.
3. Describe the importance of lubrication reaching the interior of the chain.
4. Demonstrate the operations of a dirty chain and a clean, lubricated chain.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 30

CRITERION-REFERENCED MEASURE

Questions

1. List five steps to follow in the cleaning of chains : _____; _____; _____; _____; and _____.
2. A chain covered with oil and dirt wears (more or less) than a chain that is dry and packed with dirt.
3. List three methods of chain lubrication: _____; _____; and _____.

Answers

1. remove chain from sprockets; wash chain in diesel fuel; drain diesel fuel and soak chain in oil; hang chain to drain off excess lubricant; install chain
2. less
3. manual, semi-automatic; automatic

Practical Application

Have students clean and lubricate a chain to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 30 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 30

CLEAN AND LUBRICATE CHAIN

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specifications.		
2. Removed chain guards and shields, if necessary, to gain access to chains.		
3. Removed foreign material by removing larger pieces by hand and wire brushed the remainder.		
4. Chain was cleaned and lubricated with proper lubricant.		
5. Replaced guards and shields. Tested the machine and listened for noise.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 31

TASK

Clean sprocket.

STANDARD OF PERFORMANCE OF TASK

Sprocket must operate freely after cleaning without noise.

SOURCE OF STANDARD:

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Conveyance system
Mechanic's tool set
Wire brush

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, p. 48.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, page 48.
2. Describe the importance of the chain riding properly within the sprocket.
3. Explain that sprocket's life is correlated to cleanliness.
4. Demonstrate the operation of a clean sprocket and a dirty sprocket.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 31

CRITERION-REFERENCED MEASURE

Questions

1. A dirty sprocket tends to wear ______ than a clean sprocket.
2. Clean sprockets minimize ________.
3. ______ can prevent the chain from riding properly in the teeth of the sprocket.

Answers

1. faster
2. failures
3. Debris

Practical Application

Have students clean a sprocket to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 31 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 31

CLEANING SPROCKETS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specific instructions.		
2. Removed sprocket guard or shield.		
3. Using a wire brush and cleaning fluid, if necessary, cleaned the sprocket completely.		
4. Replaced guards or shields, and tested the machine and listened for noise.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 32

TASK

Install chain idler.

STANDARD OF PERFORMANCE OF TASK

The idler must be adjusted according to the manufacturer's specifications so that the chain runs correctly.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual or assembly manual
Mechanic's tool set
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service and assembly manuals.
2. Identify basic tools.

RESOURCES

1. John Deere and Co. **Fundamentals of Service . . . Belts and Chains,** pp. 34-35.
2. Jacobs and Harrell. **Agricultural Power and Machinery,** pp. 144-46.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains,** pages 34-35.
2. List the need for conveyor chain tighteners.
3. Explain where chain tighteners should be located.
4. Describe the major types of chain tighteners.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 32

CRITERION-REFERENCED MEASURE

Questions

1. The four major types of chain tighteners are ______; ______; ______ and ______.
2. Two instances where chain tighteners should be used are ______ and ______.
3. A ______ tightener is useful for shock loading conditions.

Answers

1. screw, spring, gravity, catenary
2. where it is not practical to have adjustable centers and where center distances are great enough to cause the chain to whip too much
3. spring

Practical Application

Have students install a chain idler and adjust to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 32 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 32

INSTALLING A CHAIN IDLER

Student's Name **Date**

DIRECTIONS TO STUDENT Set-up the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual or assembly manual and determined proper procedures and adjustment.		
2. Installed the idler bracket and sprocket or wear block.		
3. Tightened the idler in place by attaching the spring or tightening a lock bolt.		
4. Tested the conveyor and observed operation.		
5. Readjusted when necessary.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 33

TASK

Replace belt sheave.

STANDARD OF PERFORMANCE OF TASK

After replacing the sheave, the belt must run in correct alignment and at the proper tension with freedom from binding or looseness as specified by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, pp. 15-16.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains,** pages 15-16.
2. List visual factors indicating excessive wear of sheaves.
3. Explain the necessity of periodic inspection for damaged sheaves and the replacement of them.
4. Describe and show students the different types of sheaves.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 33

CRITERION-REFERENCED MEASURE

Questions

1. Damaged sheaves produce ______ belt wear.
2. Cast-iron sheaves can be damaged by
   a. chipping
   b. bending
   c. both of the above.
   d. none of the above.
3. In selecting the replacement sheave it is necessary to know at least three dimensions. They are ______, ______, ______.

Answers

1. rapid
2. a
3. groove size and shape, shaft diameter, outside diameter

Practical Application

Have students replace a belt sheave.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 33 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 33

REPLACING A BELT SHEAVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed guards and shields from belt and sheave.		
3. Removed idler, if so equipped, to release tension on belt.		
4. If no idler is present, released belt tension by loosening the motor base and sliding the motor.		
5. Removed belt from sheave.		
6. Loosened set screw in sheave and slid sheave off of shaft. If sheave was tight, a puller was used to remove sheave.		
7. With sheave removed, cleaned shaft with emery cloth and inspected shaft for wear, condition of key and key way.		
8. Installed new sheave and lined up with belt and second sheave. Tightened set screw.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 33

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Replaced belt and adjusted motor slides to proper belt tension or adjusted idler pulley to obtain desired tension.		
10. Replaced guards and shields and tested machine. Observed operation and noted looseness, misalignment and/or noise of operation. Corrected these if necessary.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 34

TASK

Repair chain.

STANDARD OF PERFORMANCE OF TASK

The chain must be adjusted to work in line with its sprockets and adjusted to the manufacturer's specified tension.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Conveyance system
Mechanic's tool set
Chain breaker
Replacement chain links
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, pp. 38-42.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, pages 38-42.
2. Describe possible chain failures that need to be checked.
3. Demonstrate use of the chain breaker.
4. Show students the proper way to reconnect a chain.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 34

CRITERION-REFERENCED MEASURE

Questions

1. A ________ ________ is used to separate a chain.
2. Always ________ the chain when detaching it.
3. It is necessary to keep the chain ________ when coupling it together.

Answers

1. chain detacher
2. support
3. straight

Practical Application

Have students repair a chain and readjust the chain to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 34 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 34

REPAIRING A CHAIN

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed guards or shield to gain access to the chain.		
3. Loosened the chain idler to release tension on the chain.		
4. Used chain breaker to disconnect the damaged links.		
5. Removed chain from machine, when necessary, to make needed repairs.		
6. Replaced the damaged links.		
7. Reinstalled chain and adjusted idler to the proper chain tension.		
8. Replaced guards and shields.		
9. Tested machine and observed alignment of sprockets, chain and idler. Adjusted as necessary to obtain proper operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 35

TASK

Replace belts.

STANDARD OF PERFORMANCE OF TASK

System must operate smoothly with freedom from excessive noise. Belt must be adjusted to the proper tension and must run in the proper alignment as specified by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Conveyance system
New belt

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, p. 18.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, page 18.
2. Explain that the life of the belt is dependent on installation techniques.
3. List results of improper belt installation.
4. Stress the importance of proper belt storage.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 35

CRITERION-REFERENCED MEASURE

Questions

1. Should a belt that has been found turned over in the pulley groove be replaced?

2. Based on your answer for question #1; state why or why not the belt should be or should not be replaced.

3. Prying belts into sheaves without loosening the idler mounting bolts results in ________ ________.

Answers

1. Yes
2. When flip-over indicates one or more broken cords.
3. broken cords

Practical Application

Have students replace belts.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 35 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 35

REPLACING BELTS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed guards or shields necessary to gain access to belt pulleys.		
3. Released tensions on the belt by loosening idler pulley or sliding belt drive.		
4. Removed old belt.		
5. Installed new belt and adjusted to manufacturer's specifications, by using idler pulley or sliding drive.		
6. Replaced guards and shields and test ran machine observing operation.		
7. Corrected as necessary.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 36

TASK

Replace pickup drive belt.

STANDARD OF PERFORMANCE OF TASK

Machine must operate with freedom from noise or belt slippage. Belt tension must be adjusted to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Conveyance system
Replacement belt

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Power Trains**, pp 10-2 and 10-3.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Power Trains**, pages 10-2 and 10-3.
2. Explain the difference between pickup drive belts and normal belts.
3. Describe the importance of perfect alignment of the belt and pulley.
4. List the advantages and disadvantages of flat belts.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 36

CRITERION-REFERENCED MEASURE

Questions

1. Belts and pulleys must be in perfect _____ to prevent runoff.

2. On a conveyor system the pickup drive belt performs the _______.

   a. work
   b. turning power
   c. horse power
   d. slack

3. _______ belts require greater tension.

Answers

1. alignment
2. a
3. Flat

Practical Application

Have students replace a pickup drive belt.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 36 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 36

REPLACING A PICKUP DRIVE BELT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed guards or shields from belt pulleys.		
3. Loosened idler pulley, if equipped, and removed belt from pulleys. If no idler is present, loosened motor mounts and slide motor to loosen belts.		
4. Installed new belt.		
5. Adjusted new belt by sliding motor and retightening, or by reapplying idler and shields.		
6. Reinstalled guards and shields.		
7. Tested machine and observed belt operation. Corrected any malfunctions.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 37

TASK

Replace sprocket.

STANDARD OF PERFORMANCE OF TASK

Sprocket and chain must be in alignment and chain tension must be maintained as specified in service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement sprocket
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCES

1. John Deere and Co. **Fundamentals of Service . . . Belts and Chains**, pp. 48-50.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, p. 147.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Belts and Chains**, pages 48-50.
2. Explain possible problems causing sprocket failure.
3. Have students diagnose problem causing sprocket failure.
4. Describe how sprockets are sized.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 37

CRITERION-REFERENCED MEASURE

Questions

1. A sprocket found to have hooked teeth should be _________.
2. It is permissible to _____ a sprocket with minimum wear.
3. When not aligned properly, sprockets tend to wear on the _____ of the teeth.

Answers

1. replaced
2. reverse
3. side

Practical Application

Have students replace a sprocket and readjust the chain and sprocket assembly to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 37 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 37

REPLACING A SPROCKET

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed guards or shields to gain access to sprocket.		
3. Removed chain from sprocket by loosening idler sprocket.		
4. Removed sprocket from shaft by removing roll pin, set screw, and/or locking collar and slid sprocket off of shaft.		
5. Installed new sprocket and locking device.		
6. Replaced idler pulley.		
7. Replaced guards and shields and test ran. Observed operation and adjusted chain idler as necessary to maintain correct tension on chain.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 38

TASK

Replace elevator paddles.

STANDARD OF PERFORMANCE OF TASK

The conveyance system must operate according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Conveyance system
Replacement paddles

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCE

Hunt. **Farm Power and Machinery Management,** 7th edition. pp. 194-95.

TEACHING ACTIVITIES

1. Have students read and discuss the textbook, **Farm Power and Machinery Management,** pages 194-95.
2. Explain variables affecting conveyor capacity.
3. Demonstrate how conveyor capacity is altered by varying the angle of the conveyor.
4. Demonstrate how height of paddle affects conveyor capacity.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 38

CRITERION-REFERENCED MEASURE

Questions

1. ______ ______ can affect the conveyor capacity.
2. It is necessary to _____ _____ the power source before replacing paddles.
3. The conveyor _______ can affect the carrying capacity of the paddles.

Answers

1. Paddle wear
2. shut off
3. angle

Practical Application

Have students remove and replace elevator paddles to specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 38 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 38

REPLACING ELEVATOR PADDLES

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed bolts or fasteners holding elevator paddle in place.		
3. Removed paddle and replaced with new paddle.		
4. Replaced bolts or fasteners and tested machine.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 39

TASK

Replace speed control.

STANDARD OF PERFORMANCE OF TASK

System must operate within manufacturer's specifications for operating speeds.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
New speed controls
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret the service manual.
2. Select and use proper tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** pp. 136-41.

TEACHING ACTIVITIES

1. Have students read and discuss the textbook, **Agricultural Power and Machinery**, pages 136-41.
2. Have students consult the appropriate service manual.
3. Tell how to change speeds by varying sizes of pulleys.
4. Demonstrate procedure for using mechanical tachometers.
5. Discuss the removal of the speed control.
6. Discuss installation of a new speed control.

PERFORMANCE OBJECTIVE 39

CRITERION-REFERENCED MEASURE

Questions

1. The shaft speed can be changed by varying sizes of ______.
2. The instrument used to check the shaft speed is called a ____________.
3. The machine should not be operated with the ________ not in place.

Answers

1. pulleys
2. tachometer
3. guards

Practical Application

Have students replace the speed control in a conveyance system that will operate the system according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 39 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 39

REPLACING SPEED CONTROL

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for specific information.		
2. Removed shields or guards and linkage or hardware to gain access to speed control.		
3. Removed speed control.		
4. Installed new speed control and related linkage or hardware.		
5. Installed shield or guards and test ran machine through its range of speeds.		
6. Made adjustments as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 40

TASK

Replace charge pressure control valve, hydrostatic drive.

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications with freedom from oil leaks. Pressure must be set in accordance with service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Needed parts
Hydrostatic drive

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 159-60.
2. International Harvester Co. **I H Blue Ribbon Service**, No. GSS-1398, pp. 2-34 - 2-39.
3. John Deere and Co. **Fundamentals of Service. . . Power Trains**, pp 5-6.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 159-60.
2. Have students read and discuss textbook, **I H Blue Ribbon Service** No. GSS 1398, pages 2-34 - 2-39 and **Fundamentals of Service. . . Power Trains**, pages 5-6.
3. Demonstrate the use of a pressure tester.
4. Demonstrate proper procedure for removal of pressure control valve.
5. Discuss the importance of cleanliness.
6. Demonstrate reinstallation of pressure control valve.

PERFORMANCE OBJECTIVE 40

CRITERION-REFERENCED MEASURE

Questions

1. The ________ routes excess oil from the system charging pump to the motor housing and back to the main pump.
2. Bypass oil aids in ______ the motor and main pump.
3. ________ is the most important precaution to take in working on hydraulic systems.

Answers

1. charge pressure control valve
2. cooling
3. Cleanliness

Practical Application

Have students replace the charge pressure control valve in the hydrostatic drive and will set pressure according to specifications in service manual.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 40 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 40

REPLACING CHARGE PRESSURE CONTROL VALVE, HYDROSTATIC DRIVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety precautions.		
2. Removed all shields and sheet metal to gain access to hydrostatic drive.		
3. Removed oil plug and drained hydraulic oil.		
4. Removed pressure valve.		
5. Reassembled and replaced in machine.		
6. Replaced hydraulic oil in reservoir.		
7. Test ran and observed operation, checking for oil leaks.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 41

TASK

Replace charge pump, hydrostatic drive.

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications without leaks. Hydraulic oil must be filled to specified level.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement part(s)
Manufacturer's specified hydraulic oil
Hydrostatic drive

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCE

International Harvester Co. **I H Blue Ribbon Service**, pp. 237-39, #GSS - 1398.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **I H Blue Ribbon Service**, pages 237-39.
2. Compare worn parts with new parts on charge pump.
3. Demonstrate removal of charge pump from transmission.
4. Demonstrate reassembly of hydrostatic drive.
5. Discuss how to adjust pump pressure.

PERFORMANCE OBJECTIVE 41

CRITERION-REFERENCED MEASURE

Questions

1. What type of oil should be used in a hydrostatic system?
2. What is the purpose of a charge pump?
   a. supply
   b. charge hydraulic battery
   c. drive rear wheels
3. Pump pressure is limited by ________.

Answers

1. Oil is recommended by manufacturer.
2. a
3. relief valve

Practical Application

Have students replace charge pump and operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 41 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 41

REPLACING CHARGE PUMP HYDROSTATIC DRIVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual noting safety procedures.		
2. Removed all sheet metal and shields to gain access to hydrostatic drive. Cleaned components as necessary.		
3. Removed oil plug and drained hydraulic oil.		
4. Removed hydrostatic drive from machine.		
5. Disassembled as instructed in service manual and replaced charge pump.		
6. Reassembled and test ran machine, using new hydraulic oil in the reservoir. Observed operation and adjusted pump pressure according to service manual.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 42

TASK

Replace directional control valve, hydrostatic drive.

STANDARD OF PERFORMANCE OF TASK

The machine must operate within manufacturer's specifications without oil leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement parts
Hydrostatic drive

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. John Deere and Co. **Fundamentals of Service - Hydraulics**, pp. 3-6 to 3-9.
2. Speary Rand Corp. **Industrial Hydraulics Manual**, pp. 7-7 to 7-18.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service**, pages 3-6 to 3-9 and **Industrial Hydraulics Manual**, pages 7-7 to 7-18.
2. Have students consult the appropriate service manual.
3. Discuss location and removal of the directional control valve.
4. Explain the operation of the directional control valve.
5. Discuss reinstallation and testing of the directional control valve.

PERFORMANCE OBJECTIVE 42

CRITERION-REFERENCED MEASURE

Questions

1. The ______ routes hydraulic oil from pump to hydrostatic drive.
2. ______ is important when installing the directional control valve.
3. If the machine continues to move when placed in neutral, the directional valve linkage should be ______.

Answers

1. directional control valve
2. Cleanliness
3. adjusted

Practical Application

Have students replace the directional control valve in a hydrostatic drive and operate the machine according to manufacturer's specifications without oil leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 42 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 42

REPLACING DIRECTIONAL CONTROL VALVE, HYDROSTATIC DRIVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed all shields and sheet metal to gain access to control valve in hydrostatic drive.		
3. Removed drain plug and drained hydraulic oil.		
4. Removed control valve.		
5. Replaced control valve and all shields and sheet metal and installed new hydraulic fluid.		
6. Test ran machine and checked for oil leaks and operation of directional control valve.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 43

TASK

Replace high pressure relief valve, hydrostatic drive.

STANDARD OF PERFORMANCE OF TASK

Pressure must meet manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Hydrostatic transmission
Relief valve

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Recognize and avoid safety hazards.
3. Select and use proper tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 125-29.
2. John Deere and Co. **Fundamentals of Service Hydraulics**, pp. 3-1 to 3-4.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 125-29 and **Fundamentals of Service**, pages 3-1 to 3-4 in .
2. Have students read the appropriate service manual.
3. Discuss safety hazards involved with working on hydrostatic transmissions.
4. Discuss different types of hydrostatic transmissions, noting placement of relief valves.
5. Demonstrate removal of an internal and an external relief valve.
6. Show how to replace the relief valve and reassemble the transmission.

PERFORMANCE OBJECTIVE 43

CRITERION-REFERENCED MEASURE

Questions

1. ________ is used to protect the hydrostatic drive.
2. How many high pressure relief valves are used on a typical hydrostatic drive?
3. A common result of a defective high pressure relief valve would be ______.

Answers

1. High pressure relief valve
2. 2
3. low power

Practical Application

Have students replace the high pressure relief valve in a hydrostatic drive and operate the machine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 43 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 43

REPLACING HIGH PRESSURE RELIEF VALVE HYDROSTATIC DRIVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual noting safety procedures.		
2. Removed sheet metal and shields to gain access to area. Cleaned components as necessary.		
3. For external relief valve, removed relief valve from transmission and replaced with new unit.		
4. For internal relief valve, removed and disassembled transmission. Replaced valve and reassembled transmission.		
5. Replaced transmission, shields and guards.		
6. Test ran machine and observed. Adjusted pressure as prescribed in service manual.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 44

TASK

Grease gearbox.

STANDARD OF PERFORMANCE OF TASK

Lubricant must be filled to manufacturer's specified level.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Manufacturer's specified lubricant
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCE

John Deere and Co. **Operator's Manual - 2750 TRACTOR**, p. 91.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Operator's Manual - 2750 Tractor**, page 91.
2. Discuss types of lubricants that should be used.
3. Discuss the importance of keeping lubricant at recommended level.
4. Discuss probable causes for changes in lubricant levels in gearbox.
5. Show how to check the lubricant level.

PERFORMANCE OBJECTIVE 44

CRITERION-REFERENCED MEASURE

Questions

1. How often should gearbox lubricant level be checked?

   a. when machine does not operate properly
   b manufacturer's schedule
   c. never

2. Leaking seals could cause loss of ________ .

3. Area around filler plug should be ________ before adding oil.

Answers

1. b
2. lubricant
3. cleaned

Practical Application

Have students grease gearbox and check levels of lubricant, replacing lubricant if necessary.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 44 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 44

GREASING GEARBOX

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed check plug or dipstick and checked lubricant level in gearbox.		
3. Removed filler plug and added lubricant as necessary to bring lubricant to recommended level.		
4. Reinstalled filler plug.		
5. Rechecked lubricant level and checked for leaks.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 45

TASK

Install oil gaskets.

STANDARD OF PERFORMANCE OF TASK

Machine must operate with freedom from oil leakage.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Conveyance system
New oil gasket

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCES

1. Ford Motor Co. **Ford Tractor Repair Manual**, pp. 21-22, (ch.1).
2. Jacobs and Harrell. **Agricultural Power and Machinery**, p. 285.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Ford Tractor Repair Manual**, pages 21-22, (ch. 1), and **Agricultural Power and Machinery**, page 285.
2. Have students read the appropriate service manual.
3. Show how to inspect a machine for leaking gaskets.
4. Discuss possible causes for leaking gaskets.
5. Discuss inspection of gasket surface for anything that might prevent a good seal.
6. Demonstrate the removal of an old gasket and replacement with a new one.

PERFORMANCE OBJECTIVE 45

CRITERION-REFERENCED MEASURE

Questions

1. One of the most important tasks to perform when changing gaskets is ________.
2. Which of the following would not cause a gasket to leak?
   a. broken gasket
   b. gasket installed incorrectly
   c. not enough oil.
3. ________ gaskets should always be used when replacing gaskets.

Answers

1. cleaning
2. c
3. New

Practical Application

Have students replace the oil gasket in a conveyance system and operate machine without oil leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 45 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 45

INSTALLING OIL GASKETS

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Visually inspected machine and located leaking oil gasket or gaskets.		
3. Drained oil from housing by removing oil drain plug.		
4. Removed bolts holding housing cover in place and removed cover.		
5. Removed old oil gasket. Scraped off any small portion of gasket that may have clung to housing or have covered surfaces.		
6. Installed new gasket and covered and tightened bolts to the recommended torque.		
7. Refilled reservoir with new oil. Filled to manufacturer's specifications.		
8. Operated machine and checked for leaks.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 46

TASK

Install oil seals.

STANDARD OF PERFORMANCE OF TASK

Conveyance system must operate with freedom from oil leakage.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
New seals
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 132-34.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 132-34.
2. Discuss the different types of seals.
3. Have students list reasons for seal failure.
4. Demonstrate proper procedure for changing seals.
5. Demonstrate procedure for checking for leaks.
6. Show how to check oil level in gearbox.

PERFORMANCE OBJECTIVE 46

CRITERION-REFERENCED MEASURE

Questions

1. What should be used to polish shafts?
2. What type of seal is used for keeping dirt out and oil in?
3. Which of the following would not be a special tool for removing or installing seals?
   - a. pullers
   - b. drivers
   - c. sleeves
   - d. hammer

Answers

1. emery cloth
2. double lip type
3. d

Practical Application

Have students install oil seals, and operate the equipment without leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 46 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 46

INSTALLING OIL SEALS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed guards or shields to gain access to shaft.		
3. Removed chain or belt and sprocket or pulley from shaft.		
4. Removed old seal from housing using special seal removing tools or screwdrivers.		
5. Using emery cloth or sandpaper, polished shaft to avoid damage to new seal.		
6. Installed new seal over shaft and into housing using special seal installing tool.		
7. Reassembled components on shaft.		
8. Replaced guards or shields and test ran machine.		
9. Checked for possible oil leakage and corrected as necessary. Checked level of oil in gearbox and adjusted as needed.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 47

TASK

Replace clutch friction disk.

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications without slippage or excessive noise or vibration.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement friction disk
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 114-16.
2. **Implement and Tractor Shop Service**. No. FO 36, pp. 12-13.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 114-16 and **Implement and Tractor Shop Service**, No. FO 36, pages 12-13.
2. Discuss safety hazards concerned with clutch removal.
3. Demonstrate removal of clutch pressure plate.
4. Demonstrate assembly of clutch and pressure plate.
5. Show how to adjust the clutch.
6. Discuss common clutch problems.

PERFORMANCE OBJECTIVE 47

CRITERION-REFERENCED MEASURE

Questions

1. A ________ is used to connect or disconnect power when starting or stopping the movement of drive wheels.

2. Which of the following is not a common clutch problem?

   a. slipping
   b. jerking
   c. sticking
   d. wheel slippage

3. The movement of the clutch pedal before engagement is called __________.

Answers

1. clutch
2. d
3. free travel

Practical Application

Have students replace clutch friction disk and adjust linkage according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 47 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 47

REPLACING CLUTCH FRICTION DISK

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedure.		
2. Removed shields and sheet metal to gain access to work area. Cleaned components as necessary.		
3. Removed clutch pressure plate by removing nuts, snap rings, and/or large center nut behind Belville washer.		
4. Slid pressure plate off shaft and removed old friction disk.		
5. Installed new friction disk, pressure plate, springs and/or large center nut as required.		
6. Adjusted clutch according to service manual.		
7. Replaced shields and sheet metal.		
8. Test ran and observed operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 48

TASK

Replace countershaft.

STANDARD OF PERFORMANCE OF TASK

Machine must operate with freedom from excessive noise or vibration. Lubricant must be filled to specified level.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Shop jacks or hoists
Conveyance system
New countershaft

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 113-35.
2. Ford Motor Co. **Ford Tractor Repair Manual**, Section I, part 5, pp. 1-15.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 113-35, and **Ford Tractor Repair Manual**, section I, part 5, pages 1-15.
2. Discuss the safety hazards involved in replacing countershaft.
3. Discuss and identify parts of a transmission.
4. Demonstrate the proper removal of transmission from a machine.
5. Show the correct procedure of countershaft removal.
6. Discuss reinstallation of countershaft.
7. Demonstrate replacement of the transmission.
8. Discuss procedure for inspection of transmission operation.

PERFORMANCE OBJECTIVE 48

CRITERION-REFERENCED MEASURE

Questions

1. How do you check bearing preload?
2. What direction does the countershaft turn in relation to the input shaft?
    a. same direction
    b. opposite direction
    c. does not turn
3. What is the purpose of the engine clutch?

Answers

1. with spring scale
2. b
3. disengage power from transmission

Practical Application

Have students replace the countershaft in a transmission and will operate machine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 48 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 48

REPLACING COUNTERSHAFT

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed shields and hardware to gain access to transmission.		
3. Removed transmission from machine by removing bolts and shifter linkage.		
4. Cleaned transmission and components. Disassembled transmission as far as necessary to remove countershaft. Cleaned internal parts.		
5. Installed new countershaft and reassembled transmission.		
6. Reinstalled transmission and accessories.		
7. Installed new lubricant into transmission to proper level and test ran machine. Noticed any abnormal vibration or noise and corrected as necessary with machine stopped.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 49

TASK

Replace transmission case.

STANDARD OF PERFORMANCE OF TASK

Machine must operate according to manufacturer's specifications without excessive noise or vibration and with no lubricant leaks. Lubricant must be filled to specified level.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Manufacturer's specified lubricant
Replacement parts
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCE

Ford Motor Co. **Ford Tractor Repair Manual**, part 7, pp. 1-30.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Ford Tractor Repair Manual**, part 7, pages 1-30.
2. Have students read the appropriate service manual.
3. Discuss safety hazards involved in working with transmissions.
4. Discuss the procedure for removal of the transmission.
5. Demonstrate disassembly of the old transmission case.
6. Discuss inspection of transmission parts to be used in new case.
7. Show how to replace transmission parts in a new case and reinstall the transmission on the conveyance system.

PERFORMANCE OBJECTIVE 49

CRITERION-REFERENCED MEASURE

Questions

1. A cracked transmission case would allow ________ to leak out.
2. Before reusing transmission components, they should be ________.
3. What is used to prevent oil from leaking around transmission shafts?

Answers

1. oil
2. cleaned
3. seals

Practical Application

Have students replace the transmission case in a conveyance system and operate machine without excessive noise or vibration or lubricant leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 49 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 49

REPLACING TRANSMISSION CASE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual, noted safety procedures.		
2. Removed shields and sheet metal to gain access to transmission case. Cleaned components as necessary.		
3. Removed transmission from unit following steps in service manual as each manufacturer may have differed.		
4. Disassembled transmission according to service manual.		
5. Reassembled transmission in a new transmission case.		
6. Reinstalled transmission in conveyance system.		
7. Replaced shields and sheet metal.		
8. Installed new lubricant in transmission to proper level.		
9. Test ran and observed operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 50

TASK

Replace planetary gear.

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications without excessive noise or vibration.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement parts
Manufacturer's specified lubricant
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Ford Motor Co. **Ford Tractor Repair Manual**, part X, pp. 32-4.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 122-25.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Ford Tractor Repair Manual**, part X, pages 32-4, and **Agricultural Power and Machinery**, pages 122-25.
2. Discuss the safety precautions dealing with heavy parts and a tractor or jacks.
3. Discuss the operation of planetary gear system and identify parts of the planetary gear system.
4. Demonstrate the removal of planetary gear.
5. Demonstrate the disassembly of planetary gear system.
6. Show how to reassemble the planetary gear system.
7. Illustrate reinstallation of the planetary gear system and testing.

PERFORMANCE OBJECTIVE 50

CRITERION-REFERENCED MEASURE

Questions

1. The center gear of the planetary system is called the ________.
2. The outer gear of the planetary system is called the ________.
3. The ______ gear rotates around the sun gear.

Answers

1. sun gear
2. ring gear
3. pinion

Practical Application

Have students replace the planetary gear in a conveyance system and operate the machine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 50 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 50

REPLACING PLANETARY GEAR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual noting safety procedures.		
2. Removed all shields and sheet metal to gain access to housing. Cleaned components as necessary.		
3. Removed axle housing or housing containing planetary system, if necessary.		
4. Disassembled planetary carriers using service manual for specific instructions.		
5. Reassembled planetary carrier with new gears, shims and bearings.		
6. Reinstalled planetary system in housing and adjusted backlash clearances according to specifications. Installed new lubricant.		
7. Test ran and observed.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 51

TASK

Replace shaft.

STANDARD OF PERFORMANCE OF TASK

System must operate within manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement parts
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 141-47.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 141-47.
2. Have students consult appropriate service manual.
3. Demonstrate removal of the locking collar.
4. Show proper use of special tools such as press and puller to remove bearings.
5. Demonstrate how to check proper alignment for sprocket and shaft.
6. Illustrate adjustment of idler for proper chain tension.

PERFORMANCE OBJECTIVE 51

CRITERION-REFERENCED MEASURE

Questions

1. Chain drives are generally better for
   a. high speed application.
   b. slow speed application.
   c. where low maintenance is required.
2. Chain tighteners are always located on the _______ side of the chain.
3. Do not attempt to lubricate chain when the machine is _______.

Answers

1. b
2. slack
3. operating

Practical Application

Have students replace the shaft in a conveyance system and operate system according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 51 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 51

REPLACING SHAFT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed shields and sheet metal to gain access to conveyor shaft.		
3. Removed chain from sprocket by loosening idler sprocket.		
4. Removed sprocket from shaft by removing locking collar, roll pin and/or set screw.		
5. Removed shaft from bearings by loosening locking collar.		
6. Installed new shaft and locked in bearings.		
7. Replaced sprocket and chain, being sure that chain was running in alignment. Replaced all shields and sheet metal.		
8. Test ran and observed. Made any adjustments necessary with machine stopped.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

PERFORMANCE OBJECTIVE 52

TASK

Replace synchronizing unit.

STANDARD OF PERFORMANCE OF TASK

Unit must operate within manufacturer's specifications by shifting with freedom from grinding, noise, and vibration.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Manufacturer's specified lubricant
Replacement parts
Conveyance system
Transmission

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify parts of a synchronizer.
3. Select and use proper tools.

RESOURCE

John Deere and Co. **Fundamentals of Service. . .Power Trains**, pp. 3-5 to 3-9.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service. . . Power Trains, pages 3-5 to 3-9.**
2. Explain the function of each part of the synchronizer.
3. Show the difference between a new and worn synchronizer.
4. Discuss indications of a worn synchronizer.
5. Explain special tools needed and illustrate their use.
6. Demonstrate removal of transmission and replacement of synchronizing unit.

PERFORMANCE OBJECTIVE 52

CRITERION-REFERENCED MEASURE

Questions

1. A ________ is used to equalize the speed of mating parts before they engage.
2. A sign of worn synchronizer is ________.
3. Which of the following is a type of snychronizer?
   a. block type
   b. clutch type
   c. brake type

Answers

1. synchronizer
2. grinding
3. a

Practical Application

Have students replace the synchronizing unit and the units gear will operate without grinding, noise, and vibration.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 52 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 52

REPLACING SYNCHRONIZING UNIT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual, noted safety procedures.		
2. Removed sheet metal and shields to gain access to transmission. Cleaned components as necessary.		
3. Removed transmission from unit and disassembled according to manufacturer's service guide.		
4. Replaced synchronizing unit with new unit.		
5. Reassembled transmission using service manual procedures.		
6. Replaced transmission in unit and replaced all shields and sheet metal. Installed lubricant to proper level.		
7. Test ran and observed operation of transmission while shifting gears.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 53

TASK

Replace gears.

STANDARD OF PERFORMANCE OF TASK

Machine must operate to manufacturer's specifications without excessive noise or vibration.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Manufacturer's specified lubricant
Replacement parts
Conveyance system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 118-24.
2. **Light Utility Tractor Service Manual**, pp. 113-14.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 118-24, and **Light Utility Tractor Service Manual**, pages 113-14.
2. Discuss safety hazards involved in working with transmissions.
3. Discuss different types of gears.
4. Demonstrate adjustment of transmission bearings.
5. Demonstrate disassembly of transmission, noting placement of parts.
6. Show how to inspect gears for wear.
7. Illustrate reassembly of gear box.

PERFORMANCE OBJECTIVE 53

CRITERION-REFERENCED MEASURE

Questions

1. ________ are used to adjust preload on tapered bearings.
2. In a constant mesh system the gears remain ________.
3. ______ gears cannot be shifted because they create a side thrust and would slide out of mesh.

Answers

1. Shims
2. meshed
3. Helical

Practical Application

Have students replace the gears in a conveyance system and operate machine according to manufacturer's specifications without excessive noise or vibration.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 53 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 53

REPLACING GEARS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual noting safety procedures.		
2. Removed sheet metal and shields to gain access to transmission and gearbox. Cleaned components as necessary.		
3. Removed gearbox from machine.		
4. Disassembled gearbox.		
5. Inspected gears for wear.		
6. Reassembled gearbox using new gears as needed.		
7. Replaced gearbox in machine and replaced all shields and sheet metal. Installed new lubricant to proper level.		
8. Test ran machine.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 54

TASK

Adjust valves.

STANDARD OF PERFORMANCE OF TASK

Valves must be adjusted to manufacturer's specifications and rocker arm cover(s) must not leak.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Mechanic's tool set
Gaskets
Service manual
Feeler gauge

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. John Deere and Co. **Fundamentals of Service... Engines**, p. 2-21 to 2-22.
2. Ford Trac-com. **Cylinder Head Overhaul** (Filmstrip).

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service... Engines**, pages 2-21 to 2-22.
2. Show filmstrip, **Cylinder Head Overhaul.**
3. Demonstrate adjusting of valve stem clearance.
4. Discuss the effects of valves being out of adjustment.
5. Discuss how to determine firing order.

PERFORMANCE OBJECTIVE 54

CRITERION-REFERENCED MEASURE

Questions

1. What tool do you use to determine valve stem clearance?
2. What position does a valve need to be in to be adjusted?
3. What effect will too tight valve adjustment have?
   a. lost compression
   b. increased power
   c. valve noise

Answers

1. feeler gauge
2. closed
3. a

Practical Application

Have students adjust valves on an engine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 54 to determine if the assignment was completed for competency

CHECKLIST FOR PERFORMANCE OBJECTIVE 54

ADJUSTING VALVES

Student's Name Date

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specifications and safety procedures.		
2. Cleaned components as necessary.		
3. Ran engine until it reached specified temperature.		
4. Shut down engine.		
5. Removed rocker arm cover(s).		
6. Adjusted both intake and exhaust valves on each cylinder in firing order.		
7. Installed new gasket(s) and replaced rocker arm cover(s).		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

PERFORMANCE OBJECTIVE 55

TASK

Replace engine block.

STANDARD OF PERFORMANCE OF TASK

Engine must provide a power source capable of performing the tasks for which it is designed within specifications set by manufacturer. Engine must run in accordance with the condition of the engine. All linkages must be adjusted within manufacturer's specification. All attachment hardware must be torqued to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Vehicle which needs engine block replacement
Service manual
Mechanic's tool set
Lift capable of lifting engine assembly
New engine block
Gasket set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 242-99.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 242-99.
2. Discuss safety hazards in replacing an engine block.
3. Have students consult the appropriate service manual.
4. Discuss procedure for removal of engine.
5. List steps for disassembly of engine.
6. Demonstrate use of special tools that may be needed such as pullers, lifts, press, and wrenches.
7. Discuss the inspection of engine parts for needed replacement.
8. Demonstrate reassembly of engine block.
9. Show how to reinstall engine and adjust external linkages.
10. Discuss testing engine for problems.

PERFORMANCE OBJECTIVE 55

CRITERION-REFERENCED MEASURE

Questions

1. A ________ is used to install the piston assembly into a cylinder.

2. Bolts should be ______ when reassembling engine.

3. An engine should be mounted on an ______ for reassembly.

Answers

1. ring compressor
2. torqued
3. engine stand

Practical Application

Have students replace the engine block, adjust linkages, and operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 55 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 55

REPLACING ENGINE BLOCK

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed all components necessary to gain access to engine and engine mounts (bolts).		
3. Supported engine with lift mechanism. Supported transmission, if necessary.		
4. Removed mounting bolts.		
5. Removed engine.		
6. Disassembled engine.		
7. Installed parts in new block using new gaskets and other new parts as needed.		
8. Installed assembled engine.		
9. Replaced parts removed in earlier steps		

APPROVED: YES _____ NO ___

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 56

TASK

Replace cylinder head.

STANDARD OF PERFORMANCE OF TASK

When installed, engine must perform to manufacturer's specifications. All attachment hardware must be torqued according to manufacturer's specifications. The head gasket and exhaust manifold must not leak.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine needing a new cylinder head
Upper gasket service set
Mechanic's tool set
Feeler gauge
Torque wrench
Service manual
New cylinder head

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Recognize and avoid safety hazards.
3. Select and use proper tools.

RESOURCES

1. Ford Tra-com. **Cylinder Head Overhaul** (Filmstrip).
2. Jacobs and Harrell. **Agricultural Power and Machinery**, p. 286.
3. **Implement and Tractor Shop Service**, No. FO - 36, pp. 30-31.

TEACHING ACTIVITIES

1. Show Ford Trac-com (Filmstrip), **Cylinder Head Overhaul**.
2. Have students read and discuss textbooks, **Agricultural Power and Machinery**, page 286, and **Implement and Tractor Shop Service**, pages 30-31.
3. Demonstrate use of special tools.
4. Demonstrate removal of cylinder head.
5. Show proper technique for cleaning engine block.
6. Demonstrate assembly of new cylinder head.
7. Show how to reinstall cylinder head.

PERFORMANCE OBJECTIVE 56

CRITERION-REFERENCED MEASURE

Questions

1. ________ help to keep excess oil from passing between the valve and guide.
2. Valve rotators are usually found on ________ valves.
3. Cylinder heads should be ________ after engine reaches operating temperature.

Answers

1. Valve stem seals
2. exhaust
3. retorqued

Practical Application

Have students install a new cylinder head in an engine and the engine will operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 56 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 56

REPLACING CYLINDER HEAD

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual noting safety procedures.		
2. Removed parts to gain access to cylinder head.		
3. Removed rocker arm cover.		
4. Removed rocker arm assembly.		
5. Removed head bolts and nuts.		
6. Removed cylinder head.		
7. Cleaned block surface.		
8. Removed parts to be used on new head.		
9. Assembled new cylinder head.		
10. Installed head bolts or nuts and torqued head as prescribed by manfacturer.		
11. Installed rocker arm assembly and adjusted valve clearance as prescribed by manfacturer.		
12. Assembled parts to complete assembly of engine.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 57

TASK

Repair piston assembly.

STANDARD OF PERFORMANCE OF TASK

Assembly must be capable of combustion and transmitting combustion to crankshaft without damage to engine or piston assembly.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Piston assembly in need of repair
Service manual
Arbor press
New rings
Bushings if needed
Micrometer set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 283-85.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 283-85.
2. Illustrate the use of an arbor press and a micrometer set.
3. Show how to measure piston and pin for correct clearance.
4. Demonstrate checking of connecting rod for bends.
5. Illustrate removal and installation of rings.

PERFORMANCE OBJECTIVE 57

CRITERION-REFERENCED MEASURE

Questions

1. The arbor press is used for removal of ______.
2. ________ is used to install piston with rings into a cylinder.
3. Worn rings will cause
   a. a knocking sound.
   b. excessive engine blow by.
   c. increased compression.

Answers

1. piston pin
2. Ring compressor
3. b

Practical Application

Have students repair a piston assembly according to service manual specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 57 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 57

REPAIRING PISTON ASSEMBLY

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed old rings.		
2. Removed piston pin with press.		
3. Measured piston and pin and checked that piston and pin clearance were within limit set by manufacturer.		
4. Checked connecting rod for bends.		
5. Replaced pin in piston and connected rod in direction removed.		
6. Installed new rings.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 58

TASK

Replace cylinder head gasket.

STANDARD OF PERFORMANCE OF TASK

Head gasket must seal combustion chamber with no leakage.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Service manual
Mechanic's tool set
Straight edge
Feeler gauge
Torque wrench
New gaskets

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools

RESOURCES

1. Ford Trac-com (Filmstrip), **Cylinder Head Overhaul**.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, p. 286, No. FO-36.
3. **Implement and Tractor Shop Service**, pp. 30-31.

TEACHING ACTIVITIES

1. Show filmstrip, **Cylinder Head Overhaul**
2. Have students read and discuss textbooks, **Agricultural Power and Machinery**, page 286 and **Implement and Tractor Shop Service**, pages 30-31.
3. Demonstrate removal of head.
4. Show how to check for cylinder head straightness with straight edge and feeler gauge.
5. Discuss proper torquing sequence.

PERFORMANCE OBJECTIVE 58

CRITERION-REFERENCED MEASURE

Questions

1. What is written on some gaskets to indicate proper placement?
2. A head that is warped can usually be corrected by ________.
3. Gasket sealant should not be used on cylinder head gaskets. (True or False)

Answers

1. top
2. machining
3. True

Practical Application

Have students install a head gasket and the engine operates with no leakage in combustion chamber.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 58 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 58

REPLACING CYLINDER HEAD GASKET

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed head.		
3. Cleaned head and block surfaces.		
4. Checked head and block for distortion with straight edge.		
5. Installed new gasket and head assembly.		
6. Torqued as prescribed in service manual.		
7. Replaced all parts removed during gasket replacement.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 59

TASK

Recondition valves and valve seats.

STANDARD OF PERFORMANCE OF TASK

Valves and seats must be ground to manufacturer's specified angles.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Valve spring compressor
Valve grinder
Seat refacer set
Lapping tool
Lapping compound

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Recognize and avoid safety hazards.
3. Select and use proper tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 242-51.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 242-52.
2. Identify proper valve spring compressor, valve grinder, and valve seat grinder.
3. Discuss the importance of keeping valves and related parts in order.
4. Demonstrate how to grind valve face.
5. Demonstrate how to grind valve seats.
6. Show how to dress a grinding stone.
7. Illustrate lapping valves.
8. Discuss inspection of valves and seats for valve and seat failure.

PERFORMANCE OBJECTIVE 59

CRITERION-REFERENCED MEASURE

Questions

1. An ________ angle is attained when the valve face and seat are ground at different angles.
2. What material is used to mate valve and seat?
3. Valves and related parts should be:
   a. handled in any order
   b. kept in correct order
   c. replaced with new ones.

Answers

1. interference
2. valve lapping compound
3. b

Practical Application

Have students recondition valves and seats, grinding valves and seats to manufacturer's specified angles.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 59 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 59

RECONDITIONING VALVES AND VALVE SEATS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual, noting safety procedures.		
2. Removed valve springs and keepers, used a valve spring compressor and kept them in order for reinstallation.		
3. Checked valves, stem, and guides for wear. Replaced as necessary.		
4. Ground valves keeping them in order.		
5. Ground valves to specified face angle if necessary.		
6. Selected proper pilot to fit valve guide.		
7. Dressed refacing stone to specified angle.		
8. Refaced valve seats, redressing stone as necessary.		
9. Narrowed seats if necessary.		
10. Using lapping compound and a hand-lapping tool, mated each valve to its seat. Removed all traces of lapping compound		
11. Reinstalled valves, springs, and keepers in their original places.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 60

TASK

Remove cylinder ridge.

STANDARD OF PERFORMANCE OF TASK

Cylinder must be free of any ridge. There must be no damage to piston assembly or cylinder wall.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Cylinder with a ridge in it
Ridge reamer
Wrench to turn ridge reamer

ENABLING OBJECTIVES

1. Select and use proper tools.
2. Recognize and avoid safety hazards.
3. Read and interpret service manual.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Engines**, pp. 2-25 to 2-27.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service**, pages 2-25 to 2-27.
2. Demonstrate the use of a ridge reamer.
3. Discuss what could happen if ridge is not removed.
4. Show samples of cylinders before and after ridge is removed.
5. Discuss safety precautions when using ridge reamer.

PERFORMANCE OBJECTIVE 60

CRITERION-REFERENCED MEASURE

Questions

1. What causes a cylinder ridge?
2. What will likely be damaged if ridge is not removed?
3. What tool is used to remove the ridge?

Answers

1. ring wear
2. piston rings
3. ridge reamer

Practical Application

Have students remove a ridge from a cylinder.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 60 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 60

REMOVING CYLINDER RIDGE

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Installed ridge reamer in cylinder.		
2. Removed ridge from cylinder.		
3. Cleaned cylinder bore.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING CONVEYANCE SYSTEMS

PERFORMANCE OBJECTIVE 61

TASK

Hone and/or deglaze cylinder.

STANDARD OF PERFORMANCE OF TASK

Cylinder must be free of glaze and have cross hatched surface suitable for ring break in.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Cylinder needing glaze removed
Deglazer or hone
Drill motor ridge reamer (if ridge is present)
Cleaning solvent
Oil
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCES

1. John Deere and Co. **Fundamentals of Service . . . Engines**, pp. 2-27 to 2-28.
2. Briggs and Stratton Corp. **Service and Repair Instructions**, pp. 11-1 to 11-3.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service. . . Engines**, pages 2-27 to 2-28.
2. Discuss reasons for honing.
3. Discuss different types of honing stones.
4. Discuss difference between honing and deglazing.
5. Demonstrate honing and deglazing.
6. Illustrate how to put cross hatching on a cylinder.

PERFORMANCE OBJECTIVE 61

CRITERION-REFERENCED MEASURE

Questions

1. What can be used to lubricate cylinder hone?
2. What is the purpose of a cross hatch?
3. What part of the cylinder should be honed first?

Answers

1. oil or kerosene
2. lubricate rings
3. bottom

Practical Application

Have students hone and/or deglaze a cylinder.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 61 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 61

HONING AND/OR DEGLAZING CYLINDER

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Cleaned cylinder bore.		
2. Removed ridge if one was present.		
3. Inserted hone in cylinder and honed it until glaze was removed, producing a cross hatched finish.		
4. Checked to see that glaze was completely removed.		
5. Cleaned cylinder bore and oiled slightly to prevent rust.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

SERVICING HYDRAULICS

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 62

TASK

Adjust pressure relief valve.

STANDARD OF PERFORMANCE OF TASK

Pressure relief valve must operate within manufacturer's operating procedures.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Machine with hydraulic system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . . Hydraulics,** pp. 3-1 to 3-4.
2. **Compact Tractor Service Manual,** p. 46.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service . . . Hydraulics,** pages 3-1 to 3-4 and **Compact Tractor Service Manual,** page 46.
2. Identify the location of the relief valve on a given machine.
3. Demonstrate the proper use of gages.
4. Discuss the adjustment of relief valves using shims and adjusting screws.
5. Discuss the testing of hydraulic system.

PERFORMANCE OBJECTIVE 62

CRITERION-REFERENCED MEASURE

Questions

1. Adding a shim in a relief valve would cause pressure to
   - a. lower.
   - b. raise.
   - c. remain the same.
2. The purpose of the relief valve is to limit ______.
3. You must use the proper ______ for the system being checked.

Answers

1. b
2. operating pressure
3. gauge

Practical Application

Have students adjust the pressure relief valve in a machine with hydraulic system and operate according to manufacturer's procedures.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 62 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 62

ADJUSTING PRESSURE RELIEF VALVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed all shields and guards to gain access to hydraulic components.		
3. Followed manufacturer's instructions to gain access to pressure relief valve.		
4. Following procedures outlined in the service manual, adjusted the pressure relief valve.		
5. Reinstalled all hardware and shields that were removed and filled hydraulic reservoir to proper level.		
6. Tested hydraulic system for proper operating pressure as described in manual.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 63

TASK

Bleed air from hydraulic system.

STANDARD OF PERFORMANCE OF TASK

System must operate to manufacturer's specifications and be free from chatter.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Manufacturer's specified fluid
Hydraulic system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Recognize and avoid safety hazards.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Hydraulics**, p. 4-8.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service. . . Hydraulics**, page 4-8.
2. Demonstrate procedure for checking fluid levels.
3. Discuss why some systems would require more fluid for certain applications.
4. Discuss the effect trapped air would have on a system.
5. Demonstrate bleeding of air from hydraulic cylinders.

PERFORMANCE OBJECTIVE 63

CRITERION-REFERENCED MEASURE

Questions

1. What action will a hydraulic system have containing air?
2. What will most likely be damaged in a hydraulic system containing air?
3. How many times should an operator extend and retract a cylinder to remove air?

Answers

1. sluggish
2. pump
3. 7 or 8

Practical Application

Have students bleed air from a hydraulic system.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 63 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 63

BLEEDING AIR FROM HYDRAULIC SYSTEM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for specific bleeding procedures.		
2. Checked fluid level of hydraulic system and adjusted if necessary.		
3. Bled system according to manufacturer's instruction.		
4. Rechecked fluid level.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 64

TASK

Change hydraulic filter.

STANDARD OF PERFORMANCE OF TASK

The filters must be installed according to manufacturer's specifications and the housing must not leak.

SOURCE OF STANDARD

Hydraulics, pp. 40-41.
Fundamentals of Service -- Hydraulics, p. 7-1.

CONDITIONS FOR PERFORMANCE OF TASK

Filters recommended by the manufacturer
Service manual
Needed parts
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret the service manual.
2. Select and use proper tools.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 7-1 to 7-7.
2. **Implement and Tractor Service Manual**, p. 94, Number I-H 39.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service. . . Hydraulics**, pages 7-1 to 7-7.
2. Have students read and discuss proper steps in changing filter on a given tractor in **Implement and Tractor Service Manual.**
3. Show how a hydraulic filter seals by using a cut away of a hydraulic filter.
4. Discuss the causes and changes of leaks.
5. Explain special tools needed in changing the filter, and illustrate their use.

PERFORMANCE OBJECTIVE 64

CRITERION-REFERENCED MEASURE

Questions

1. ________ filters are seldom used in a hydraulic system.
2. The most common measurement used to determine degree of filtration is a ________.
3. Which of the following is not a source of contamination?
   a. air
   b. hydraulic machine itself
   c. hydraulic oil
   d. using correct replacement filter

Answers

1. Absorbent
2. micron
3. d

Practical Application

Have students install hydraulic filter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 64 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 64

CHANGING HYDRAULIC FILTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Read manufacturer's service manual to determine location of filter(s).		
2. Removed all parts necessary to reach and removed filter(s).		
3. Cleaned area around filter(s).		
4. Removed filter(s).		
5. Installed the filter(s) recommended by the manufacturer,following instructions in the service manual.		
6. Reassembled and reinstalled all parts removed.		
7. Tested hydraulic system for correct operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 65

TASK

Flush and clean hydraulic system.

STANDARD OF PERFORMANCE OF TASK

There must be no damage to the system and flushing must continue until system is clean.

SOURCE OF STANDARD

Fundamentals of Service - Hydraulics, p. 11-4.

CONDITIONS FOR PERFORMANCE OF TASK

Manufacturer's service manual
Manufacturer's specified hydraulic fluid
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 7-1 to 7-8, 8-1 to 8-2.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 172-73.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service. . . Hydraulics**, pages 7-1 to 7-8 and 8-1 to 8-2, and **Agricultural Power and Machinery**, pages 172-73.
2. Discuss the safety hazards in oil trapped under pressure in the system.
3. Discuss the procedure for discharging accumulators.
4. Discuss the areas of system to be drained, including filters.
5. Discuss the types of solvents that can be used to flush system.
6. Show how to remove air trapped in system.

PERFORMANCE OBJECTIVE 65

CRITERION-REFERENCED MEASURE

Questions

1. Oil change schedules are set by __________.
2. Hydraulic oil should be changed when the system is ______.
3. Always remove ______ from system after refilling with oil.

Answers

1. manufacturer
2. hot
3. air

Practical Application

Have students flush and clean a hydraulic system according to specification.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 65 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 65

FLUSHING AND CLEANING HYDRAULIC SYSTEM

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for specific instructions.		
2. Relieved all hydraulic pressure before disconnecting any parts of the system, and discharged the accumulator if used. Checked to be sure solvents did not come in contact with packing or seals.		
3. Drained system.		
4. Flushed system.		
5. Serviced filters.		
6. Refilled and bled system.		
7. Rechecked fluid level and checked for leaks.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 66

TASK

Drain and refill hydraulics system.

STANDARD OF PERFORMANCE OF TASK

The fluid must be added to the correct level and the system must operate smoothly as specified in the service manual.

SOURCE OF STANDARD

Fundamentals of Service - Hydraulics, pp. 11-4 to 11-5.

CONDITIONS FOR PERFORMANCE OF TASK

Hydraulic system
Service manual
Manufacturer's hydraulic fluid

ENABLING OBJECTIVES

1. Read and interpret the service manual.
2. Select and use proper tools.

RESOURCE

Implement and Tractor Service Manual, Number IH-39, p. 4.

TEACHING ACTIVITIES

1. Have students point out areas where contaminants might enter system when changing fluid.
2. Have students read and discuss textbook, **Implement and Tractor Service Manual**, page 4.
3. Demonstrate method of bleeding a hydraulic system.
4. Have students select proper size container to drain fluid.
5. Have students demonstrate safety measures in changing fluids.

PERFORMANCE OBJECTIVE 66

CRITERION-REFERENCED MEASURE

Questions

1. Hydraulic oil drains from the system better when the oil is ________.
2. Oil levels should be checked when
   a. oil is cold.
   b. oil is hot.
   c. all cylinders are retracted.
3. Removing air from the system is called ______.

Answers

1. warm
2. b
3. bleeding

Practical Application

Have students drain hydraulic oil from a system and refill it with new oil.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 66 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 66

DRAINING AND REFILLING HYDRAULIC SYSTEM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Drained the system, taking all necessary precautions as described in the service manual.		
3. Cleaned the area around the filler cap.		
4. Filled with fluid to recommended level.		
5. Replaced filler cap.		
6. Bled system and added fluid as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 67

TASK

Hone hydraulic cylinder walls.

STANDARD OF PERFORMANCE OF TASK

Cylinder walls must be clean and have an even finish. There must be no deep scores or scratches on cylinder walls.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Cylinder hone
Hydraulic cylinder

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery,** pp. 167-68.
2. Speary Rand Corp. **Industrial Hydraulics Manual,** pp. 6-1 to 6-7.
3. Pease. **Basic Fluid Power,** pp. 54-61.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 167-68, **Industrial Hydraulics Manual**, pages 6-1 to 6-7, and **Basic Fluid Power**, pages 54-61.
2. Discuss safety hazards of oil under pressure and raised implements
3. Show how to inspect a cylinder for damaged parts.
4. Demonstrate honing a hydraulic cylinder.
5. Show how to determine if honing has produced a good cylinder wall.

PERFORMANCE OBJECTIVE 67

CRITERION-REFERENCED MEASURE

Questions

1. Worn cylinder walls cause ________ leaks.
2. With what should parts be lubricated when reassembling cylinder?
3. The process of evenly removing metal from the inside of a cylinder is called ______.

Answers

1. internal
2. hydraulic oil
3. honing

Practical Application

Have students hone hydraulic cylinder walls.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 67 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 67

HONING HYDRAULIC CYLINDER WALLS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specific instructions.		
2. Removed hydraulic cylinder from machine.		
3. Removed piston and rod from hydraulic cylinder.		
4. Mounted cylinder in vise.		
5. Inserted cylinder hone into cylinder and attached to electric drill motor.		
6. Lubricated cylinder walls and cylinder hone with light oil or hydraulic fluid.		
7. Using up and down motions honed the cylinder to remove scratches, scores and sludge.		
8. Removed hone and checked for a good quality even finish on cylinder walls.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 68

TASK

Replace check valve.

STANDARD OF PERFORMANCE OF TASK

The hydraulic system must operate to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Manufacturer's specified hydraulic fluid
Hydraulic valve body

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Understand and follow directions.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 125-29.
2. John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 3-6 to 3-7.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 125-29 and **Fundamentals of Service. . . Hydraulics**, pages 3-6 to 3-7.
2. Have students consult the proper service manual.
3. Discuss operation of the check valve.
4. Discuss location of the check valve.
5. Show how to remove the check valve and reinstall a new one.
6. Discuss the importance of cleaning valve body before installing the check valve.

PERFORMANCE OBJECTIVE 68

CRITERION-REFERENCED MEASURE

Questions

1. The ________ valve is usually used to prevent oil from flowing in more than one direction.
2. The valve body should be ______ before a check valve is installed.
3. A simple check valve consists of a ball and ______.

Answers

1. check
2. cleaned
3. spring

Practical Application

Have students replace the check valve in a hydraulic system and operate the system according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 68 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 68

REPLACING CHECK VALVES

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual, for specific instructions.		
2. Removed hydraulic valve body from machine if necessary.		
3. Removed check valve, cleaned valve body and installed new check valve.		
4. Reinstalled valve body, if removed.		
5. Filled to specified level with hydraulic fluid.		
6. Test ran machine to check operation of hydraulic system.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 69

TASK

Replace hydraulic hoses.

STANDARD OF PERFORMANCE OF TASK

The hose fittings must be torqued to manufacturer's specifications with no leaks around fittings.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Hydraulic system
Service manual
Mechanic's tool set
Replacement hose

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 175-79.
2. John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 8-3 to 8-12.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 175-79 and **Fundamentals of Service. . . Hydraulics**, pages 8-3 to 8-12.
2. Discuss the safety hazards dealing with oil under pressure and raised implements.
3. Demonstrate the removal of hoses.
4. Discuss the selection of proper replacement hoses.
5. Demonstrate the correct use of thread sealant.
6. Discuss the proper hose insulation.

PERFORMANCE OBJECTIVE 69

CRITERION-REFERENCED MEASURE

Questions

1. Replacement hoses should be the proper type and ______.
2. One advantage of hydraulic hoses is
   a. they are cheaper.
   b. they last longer.
   c. they allow for motion.
3. One thing to avoid when installing a hose is ________.

Answers

1. size
2. c
3. sharp bends

Practical Application

Have students replace hydraulic hoses and torque hose fittings according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 69 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 69

REPLACING HYDRAULIC HOSES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Lowered hydraulic implements and relieved all hydraulic pressure.		
3. Loosened connecting nuts and removed hose from machine.		
4. Installed new hydraulic hose using a thread sealant if required.		
5. Tightened line fitting to specifications.		
6. Operated machine and checked for leaks and proper operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 70

TASK

Replace hydraulic cylinders.

STANDARD OF PERFORMANCE OF TASK

The cylinder(s) must operate according to manufacturer's specifications with no leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement cylinder
Machine needing a new cylinder

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 4-1 to 4-8.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 166-69.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service. . . Hydraulics**, pages 4-1 to 4-8 and **Agricultural Power and Machinery**, pages 166-69.
2. Discuss safety hazards of oil under pressure and raised implements.
3. Discuss matching of cylinder and fittings to those being replaced.
4. Discuss the importance of cleaning components before replacing.
5. Demonstrate how to remove cylinder.
6. Show how to reinstall cylinder and check for leaks.

PERFORMANCE OBJECTIVE 70

CRITERION-REFERENCED MEASURE

Questions

1. ______ oil must be released before removing lines.
2. Cleaning the cylinder and fittings prevents ______ from entering the system.
3. After a new cylinder is installed, ______ should be removed from the system.

Answers

1. Trapped
2. dirt
3. air

Practical Application

Have students replace the hydraulic cylinder and operate according to manufacturer's specifications with no leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 70 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 70

REPLACING HYDRAULIC CYLINDERS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual, noted safety procedures.		
2. Removed hardware to gain access to cylinder.		
3. Relieved any pressure from hydraulic system.		
4. Removed hoses or lines leading to cylinders.		
5. Removed pins holding cylinder in place.		
6. Removed cylinder. Cleaned components as necessary.		
7. Installed new cylinder and pins.		
8. Reconnected hoses using thread sealer and reinstalled shields and guards.		
9. Test ran machine and checked for operation and leaks.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 71

TASK

Replace hydraulic fittings.

STANDARD OF PERFORMANCE OF TASK

The fitting must not leak under operating pressure.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Hydraulic system
Mechanic's tool set
Replacement parts
Manufacturer's specified hydraulic fluid

ENABLING OBJECTIVES

1. Select and use proper tools.
2. Read and interpret service manual.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 176-79.
2. John Deere and Co. **Fundamentals of Service. . .Hydraulics**, pp. 8-8 to 8-16.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 176-79 and **Fundamentals of Service. . .Hydraulics**, pages. 8-8 to 8-16.
2. Discuss safety hazards of trapped oil and raised implements.
3. Show different types of fittings and connections.
4. Show proper routing of lines and hoses.
5. Show how to inspect hoses and lines for anything that might damage new fittings.
6. Illustrate how to install fittings.

PERFORMANCE OBJECTIVE 71

CRITERION-REFERENCED MEASURE

Questions

1. One type of hose fitting is permanent; the other is ________.
2. More damage has been done to fittings by ________ than any other cause.
3. The main cause of hose failure is ________ .

Answers

1. reusable
2. over tightening
3. improper routing

Practical Application

Have students replace hydraulic fittings so that they do not leak under operating pressure.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 71 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 71

REPLACING HYDRAULIC FITTINGS

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed line or hose from fittings.		
2. Removed fitting.		
3. Checked threads, flanges and flairs for burrs or nicks which could cause damage to new fittings.		
4. Where needed, installed sealing O-rings on fitting.		
5. Installed fitting to correct tightness. If a lock nut was used, installed to correct angle, and tightened lock nut.		
6. Installed line to fitting, checking to be sure it was free and had no twist or bend.		
7. Tightened line making sure that the sealing flange did not turn.		
8. Operated system, checking for leaks.		
9. Refilled the hydraulic system to manufacturer's recommended level.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 72

TASK

Replace hydraulic lines.

STANDARD OF PERFORMANCE OF TASK

Lines must not leak under normal operating pressures.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement lines
Machine

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.

RESOURCE

John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 8-12 to 8-17.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Hydraulics**, pages 8-12 to 8-17.
2. Discuss the safety hazards dealing with oil under pressure and raised implements.
3. Demonstrate the removal of lines with line wrenches.
4. Discuss the different types of lines.
5. Discuss the proper routing of hydraulic lines.
6. Show how to install new lines with thread sealer.

PERFORMANCE OBJECTIVE 72

CRITERION-REFERENCED MEASURE

Questions

1. What type of pipe should not be in hydraulic lines?
2. You should avoid ______ when routing hydraulic lines.
3. ______ can be used to reduce leaks on line connections.

Answers

1. galvanized
2. straight lines
3. Thread sealer

Practical Application

Have students replace hydraulic lines so that they will not leak under operating pressure.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 72 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 72

REPLACING HYDRAULIC LINES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed hardware as necessary to gain access to hydraulic lines.		
3. Relieved any pressure from hydraulic cylinder.		
4. Using line wrenches, loosened the line attaching nuts.		
5. Removed the line.		
6. Installed new line using thread sealer.		
7. Tightened the line using line wrenches.		
8. Reinstalled hardware and tested operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 73

TASK

Replace hydraulic piston.

STANDARD OF PERFORMANCE OF TASK

System must operate according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement piston
Machine with a hydraulic system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 166-69.
2. Ford Motor Co. **Ford Tractor Repair Manual**, Section II, pp. 16-22.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 166-69 and **Ford Tractor Repair Manual**, Section II, pages 16-22.
2. Demonstrate the use of special tools.
3. Discuss safety hazards.
4. Show how to remove the cylinder from the machine.
5. Demonstrate the disassembly of the cylinder.
6. Discuss the honing procedure and final inspection before reassembly.
7. Show how to reassemble piston and packing.
8. Demonstrate the replacing of the cylinder on machine and testing of the machine.

PERFORMANCE OBJECTIVE 73

CRITERION-REFERENCED MEASURE

Questions

1. What should never be used in removal of piston from cylinder?
2. Scored cylinder walls will cause
    a. faster acting cylinder.
    b. build-up of excess pressure.
    c. slower acting cylinder.
3. What should cylinder walls be cleaned with after honing?

Answers

1. compressed air
2. a
3. hot soapy water

Practical Application

Have students replace the hydraulic piston and operate the hydraulic system according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 73 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 73

REPLACING HYDRAULIC PISTON

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual and noted safety procedures.		
2. Removed hardware as necessary to gain access to the hydraulic cylinder.		
3. Removed hydraulic cylinder and piston assembly.		
4. Mounted assembly in vise or holding fixture and removed piston assembly. Cleaned all components and honed cylinder if necessary.		
5. Installed new O-ring or sealing rings on piston and inserted new piston into cylinder using ring compression tools if necessary.		
6. Reinstalled cylinder in machine and replaced all hardware.		
7. Test ran machine and observed operation of hydraulic system. Corrected as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 74

TASK

Replace packing.

STANDARD OF PERFORMANCE OF TASK

Cylinder must operate with freedom of movement and with no hydraulic leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement packing
Hydraulic cylinder

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . . Hydraulics**, pp. 4-1 to 4-8.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 166-69.
3. Speary Rand Corp. **Industrial Hydraulics Manual**, pp. 411-21.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service. . . Hydraulics**, pages 4-1 to 4-8, **Agricultural Power and Machinery** pages 166-69 and **Industrial Hydraulics Manual**, pages 411-21.
2. Discuss safety hazards in removing cylinders and replacing packing.
3. Demonstrate the removal of a cylinder from the machine.
4. Show different types of cylinder gland retainers.
5. Demonstrate the removal and reinstallation of cylinder packing.
6. Illustrate the procedure for replacing the cylinder on the machine and for testing the system.

PERFORMANCE OBJECTIVE 74

CRITERION-REFERENCED MEASURE

Questions

1. A piston type cylinder gives ______ type of movement.
2. What type of cylinders gives force in only one way?
3. What type of leak would be caused by worn piston packing?

Answers

1. straight
2. single acting
3. internal

Practical Application

Have students replace the packing in a cylinder and test operation of a hydraulic system.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 74 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 74

REPLACING PACKING

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted the service manual.		
2. Disconnected lines and removed cylinder from machine.		
3. Mounted cylinder in vise or holding fixture.		
4. Removed yoke from end of cylinder piston.		
5. Unscrewed packing gland nut and removed from piston.		
6. Pried out old packing and discarded.		
7. Inserted new packing of the size and length recommended.		
8. Replaced packing nut and yoke.		
9. Tightened packing nut as outlined in service manual to prevent leakage.		
10. Replaced cylinder on machine and tested operation of hydraulic system. Corrected as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 75

TASK

Repair hydraulic motors.

STANDARD OF PERFORMANCE OF TASK

The disassembly and reassembly must follow instructions in the service manual. There must be no damage to parts, and all worn or damaged parts must be repaired or replaced. There must be no hydraulic fluid leaks, and the motor must operate according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Manufacturer's service manual
Mechanic's tool set
Replacement parts

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Understand and follow directions.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . .Hydraulics**, pp.5-1 to 5-12.
2. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 168-69.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service. . Hydraulics**, pages 5-12 and **Agricultural Power and Machinery**, pages 168-69.
2. Have students read instructions in the appropriate service manual.
3. Discuss different types of hydraulic motors.
4. Demonstrate the disassembly and inspection of a hydraulic motor.
5. Identify parts of a hydraulic motor.
6. Discuss repair procedure, noting correct placement of parts.

PERFORMANCE OBJECTIVE 75

CRITERION-REFERENCED MEASURE

Questions

1. Hydraulic motors deliver a ________ motion.
2. The amount of oil being pumped to a hydraulic motor determines the ______ of the motor.
3. Hydraulic motors and pumps can be very similar in ____________.

Answers

1. rotary
2. speed
3. appearance

Practical Application

Have students repair a hydraulic motor and operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 75 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 75

REPAIRING HYDRAULIC MOTORS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Followed instructions in the service manual to reach and remove the hydraulic motor.		
2. Disassembled motor, noting position of the parts.		
3. Inspected and repaired or replaced all worn or damaged parts.		
4. Reassembled in the order specified in the service manual, checking lines and connections for fluid leaks, and installing new seals.		
5. Operated motor and adjusted if necessary.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 76

TASK

Replace hydraulic pumps.

STANDARD OF PERFORMANCE OF TASK

System must operate as outlined in service manual at specified pressure and with freedom from leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement hydraulic pump
Machine with hydraulic system

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. Ford Motor Co. **Ford Tractor Repair Manual**, Part II, pp. 55-60.
2. John Deere and Co. **Fundamentals of Service. . .Hydraulics**, pp. 2-1 to 2-21.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Ford Tractor Repair Manual**, Part II, pages 55-60 and **Fundamentals of Service. . .Hydraulics**, pages 2-1 to 2-21.
2. Discuss removal of pressure from pump lines.
3. Discuss the importance of cleanliness in removal and reinstallation of pump.
4. Show how to remove hydraulic lines with line wrenches.
5. Demonstrate the removal of pump.
6. Show how to remove gear drive from old pump and how to put it on new pump.
7. Show how to reinstall new pump and test machine.

PERFORMANCE OBJECTIVE 76

CRITERION-REFERENCED MEASURE

Questions

1. Pump ________ is very important when installing new pump.
2. A new pump should be ______ before running.
3. Machines should be cleaned before replacing pump to keep ______ out of the system.

Answers

1. alignment
2. primed
3. dirt

Practical Application

Have students replace the hydraulic pump and operate the system without leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 76 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 76

REPLACING HYDRAULIC PUMPS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for specific details.		
2. Relieved pressure from the system. Removed hardware to gain access to pump.		
3. Removed hydraulic supply and pressure lines from pump using line wrenches.		
4. Unbolted and removed pump.		
5. Removed gear drive from old pump and placed on new pump, if necessary.		
6. Placed new pump in place and tightened in accordance with the factory specifications.		
7. Replaced all hydraulic lines and hardware.		
8. Test ran machine and bled system if necessary.		
9. Test ran machine and observed operation of hydraulic system. Using test equipment, checked for proper operating pressure. Adjusted as necessary as outlined in the service manual.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 77

TASK

Service hydraulic valves.

STANDARD OF PERFORMANCE OF TASK

Valves must operate according to manufacturer's specifications with no leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Machine with hydraulics

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Recognize and avoid safety hazards.

RESOURCES

1. **Light Utility Tractor Service Manual**, pp. 98-102.
2. John Deere and Co. **Fundamentals of Service. . .Hydraulics**, pp. 3-1 to 3-22.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Light Utility Tractor Service Manual**, pages 98-102 and **Fundamentals of Service. . .Hydraulics**, pages 3-1 to 3-23.
2. Discuss removal of valve body.
3. Show how to disassemble and inspect the valve body and parts.
4. Discuss the importance of cleanliness.
5. Demonstrate how to reassemble valve body.

PERFORMANCE OBJECTIVE 77

CRITERION-REFERENCED MEASURE

Questions

1. What is usually used to control external leakage on the control valve spool?
2. What type of valve is used to control the direction of oil flow within a hydraulic system?
3. What should parts be lubricated with when they are reassembled in a valve?

Answers

1. O-ring
2. directional control valve
3. hydraulic oil

Practical Application

Have students service hydraulic valves and operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 77 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 77

SERVICING HYDRAULIC VALVES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed valve body from machine.		
3. Disassembled valve body carefully noticing any broken O-rings, scored passages, and/or plugged orifices. Inspected pistons and valves for wear and scoring.		
4. Cleaned all components with clean solvent.		
5. Installed new O-rings, gaskets, and other parts as needed and reassembled valve body.		
6. Replaced valve body in machine and tested for proper operation of hydraulic system.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING HYDRAULICS

PERFORMANCE OBJECTIVE 78

TASK

Repair hydraulic pumps (gear, piston, vane).

STANDARD OF PERFORMANCE OF TASK

Faulty components must be identified and repaired or replaced and pump must perform to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Hydraulic pump
Mechanic's tool set
Service manual
Micrometer
Torque wrench
Clean rags
Replacement parts
Hydraulic fluid

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use proper tools.
3. Understand and follow instructions.

RESOURCES

1. John Deere and Co. **Fundamentals of Service. . .Hydraulics**, pp. 2-1 to 2-21.
2. **Light Utility Tractor Service Manual**, pp. 154-55.
3. Ford Motor Co. **Ford Tractor Repair Manual**, Section II, pp. 55-66.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Fundamentals of Service. . . Hydraulics**, pages 2-1 to 2-2, **Light Utility Tractor Service Manual**, pages 154-55 and **Ford Tractor Repair Manual**, Section II, pages 55-66.
2. Show students examples of gear, piston, and vane pumps.
3. Discuss the operation of each type of pump.
4. Show the location of and proper steps for removal of each type of pump.
5. Illustrate the disassembly procedure for each type of pump.
6. Show the inspection procedure.
7. Demonstrate the reassembly and installation of the pumps.
8. Discuss the bleeding of the system and checking of fluid level.

PERFORMANCE OBJECTIVE 78

CRITERION-REFERENCED MEASURE

Questions:

1. Which type of pump has the fewest moving parts?
2. ________ is the greatest cause of pump failure.
3. Cavitation occurs when ______ gets into the system.

Answers

1. gear
2. Contaminated fluid
3. air

Practical Application

Have students repair a hydraulic pump so that it performs according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 78 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 78

REPAIRING HYDRAULIC PUMPS (GEAR, PISTON, VANE)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for specific instructions.		
2. Removed pump.		
3. Cleaned pump of all dirt and grime.		
4. Disassembled pump.		
5. Inspected for wear and replaced parts as necessary.		
6. Reassembled pump.		
7. Reinstalled pump and bled system. Rechecked fluid level.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

SERVICING CARBURETION AND FUEL SYSTEMS

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 79

TASK

Bleed diesel fuel system.

STANDARD OF PERFORMANCE OF TASK

System must be free of all air and operate efficiently, without fuel leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Diesel fuel system needing bleeding
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify components of the fuel system.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**. pp. 209-10.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 209-10.
2. Discuss the effects of air in a diesel fuel system.
3. Discuss situations which create a need to bleed diesel fuel systems.
4. Show a picture or diagram of components of a typical diesel fuel system, identifying all components.
5. Explain that all diesel fuel systems do not have all parts shown in activity # 3.
6. Have students bleed a diesel fuel system using a service manual for that engine.

PERFORMANCE OBJECTIVE 79

CRITERION-REFERENCED MEASURE

Questions

1. When bleeding diesel fuel systems which component is generally bled first?

    a. injection lines
    b. injection pump
    c. primary filter
    d. secondary filter

2. Bleed screws should be left open until

    a. air bubbles appear.
    b. air bubbles discontinue.
    c. engine starts.
    d. hand pump can no longer be operated.

3. The purpose of bleeding diesel fuel systems is to remove _____ from the system.

Answers

1. c
2. b
3. air

Practical Application

Have students bleed a diesel fuel system to remove all air so that engine runs properly.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 79 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 79

BLEEDING A DIESEL FUEL SYSTEM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Filled fuel tank with diesel fuel. Turned on fuel.		
3. Using hand primer or gravity feed, begin to force fuel through system.		
4. Opened bleed screw on primary filter and left open until all air bubbles stopped and a steady flow of fuel was obtained. Tightened the screw.		
5. Followed same procedure on secondary filter.		
6. Followed same procedure on injection pump.		
7. Used engine starter, bled fuel lines to injectors.		
8. Operated engine and checked for performance and fuel leaks.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 80

TASK

Clean diesel fuel injector.

STANDARD OF PERFORMANCE OF TASK

Clean according to the manufacturer's recommended procedure. Upon completion all parts must be free of oil, dirt and contaminants.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Diesel injector needing to be cleaned
Service manual
Mechanic's tool set
Test stand
Solvent
Any special tools required

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Recognize correct injector spray pattern.
3. Recognize safety hazards associated with injector testing.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 206-08.

TEACHING ACTIVITIES

1. Discuss the problems associated with dirty injectors.
2. Demonstrate the use of injector testing equipment.
3. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 206-08.
4. Demonstrate proper cleaning of internal components.
5. Have students clean a diesel fuel injector.

PERFORMANCE OBJECTIVE 80

CRITERION-REFERENCED MEASURE

Questions

1. Injector nozzle components should be cleaned with

   a. steel brush.
   b. pocket knife.
   c. emery cloth.
   d. brass wire brush.

2. The first step in cleaning an injector is

   a. scrape carbon from tip.
   b. soak in gasoline.
   c. read specific information in service manual.
   d. blow with compressed air.

3. Which problem can be caused by dirty injector nozzles?

   a. irregular running
   b. black/gray exhaust smoke
   c. hard starting
   d. any of these

Answers

1. d
2. c
3. d

Practical Application

Have students clean, reassemble and test a diesel fuel injector according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 80 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 80

CLEANING AND SERVICING DIESEL FUEL INJECTOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Mounted injector on test stand and observed spray pattern and opening pressure.		
3. Thoroughly cleaned injector with solvent and removed carbon from tip prior to disassembly.		
4. Disassembled injector following recommended procedures in service or manufacturer's manual.		
5. Cleaned internal components as recommended by manufacturer.		
6. Reassembled, tested and adjusted according to procedures and specifications in manual.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

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DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 81

TASK

Rebuild carburetor.

STANDARD OF PERFORMANCE OF TASK

Carburetor must be disassembled, cleaned, reassembled and adjusted according to manufacturer's specifications for flow and mixture. The engine idle speed must be adjusted to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Carburetor that needs rebuilding
Service manual
Carburetor cleaner
Necessary parts
Mechanic's tool set
Equipment

ENABLING OBJECTIVES

1. Read and interpret carburetor repair kit manufacturer's instructions.
2. Recognize worn or damaged carburetor parts.
3. Select and use appropriate carburetor service tools including gauges supplied by kit manufacturer.
4. Identify carburetor components.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 280-82.

TEACHING ACTIVITIES

1. Have students read and discuss the sections on carburetor servicing in **Automotive Encyclopedia**, pages 280-82.
2. Discuss procedures for cleaning carburetor parts.
3. Show models of worn or damaged carburetor parts.
4. Have students label parts of a typical carburetor.
5. Have students list parts which should not be washed in carburetor cleaning fluid.
6. Demonstrate carburetor adjustment procedures.
7. Have students rebuild a carburetor.

PERFORMANCE OBJECTIVE 81

CRITERION-REFERENCED MEASURE

Questions

1. To clean small passages in a carburetor use

   a. fine wires.
   b. steel brush.
   c. compressed air.
   d. none of these.

2. Float level is generally set using

   a. open end wrench.
   b. gauge provided in kit.
   c. plastigage.
   d. 2-3" micrometer.

3. Final carburetor adjustments should be made with

   a. engine at operating temperature.
   b. engine cold.
   c. either a and b.
   d. neither a or b.

Answers

1. c
2. b
3. a

Practical Application

Have students rebuild a carburetor and make all necessary adjustments to permit proper engine operation.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 81 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 81

REBUILDING CARBURETOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Removed carburetor from vehicle and drained fuel.		
2. Disassembled carburetor and placed in carburetor cleaner, if necessary.		
3. After cleaning, reassembled carburetor, replacing components as required.		
4. Performed all carburetor adjustments and procedures and specifications.		
5. Reinstalled on engine.		
6. Brought engine up to operating temperatures and completed adjustments.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 82

TASK

Replace diesel injection pump.

STANDARD OF PERFORMANCE OF TASK

Remove and replace diesel injection pump following manufacturer's recommended procedures. Injector must be seated squarely in cylinder head with no fluid leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Diesel engine needing an injection pump replaced
Service manual
Replacement injection pump
Clean diesel fuel
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret a service manual.
2. Select and use appropriate mechanic's tools.
3. State why pump timing is necessary to engine operation.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 209-10, 288.

TEACHING ACTIVITIES

1. Discuss the significance of injection pump timing.
2. Demonstrate procedure for positioning engine appropriately prior to pump removal.
3. Have students read and discuss sections on bleeding diesel fuel systems in textbook, **Agricultural Power and Machinery**, pages 209-10.
4. Discuss the significance of cleanliness, air bleeding and safety during pump removal and replacement.
5. Demonstrate the entire procedure of pump removal/replacement and have students collect specific information for the procedure from the appropriate service manual.
6. Have students remove and replace an injection pump according to manufacturer's specifications.

PERFORMANCE OBJECTIVE 82

CRITERION-REFERENCED MEASURE

Questions

1. When replacing an injection pump the engine position should be
    - a. TDC.
    - b. BDC.
    - c. BTDC.
    - d. as specified in the manufacturer's service manual.
2. When replacing an injection pump, which process would be performed first?
    - a. adjust pump timing
    - b. disconnect fuel lines
    - c. remove pump
    - d. turn off fuel at tank
3. The last job performed when replacing an injector pump is
    - a. check timing.
    - b. operate engine and check for leaks.
    - c. bleed nozzles.
    - d. open fuel valve at tank.

Answers

1. d
2. d
3. b

Practical Application

Have students remove and replace a diesel fuel injection pump according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 82 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 82

REPLACING DIESEL FUEL INJECTION PUMP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Followed manufacturer's recommended procedures positioning engine prior to pump removal. (Example: #1 Cylinder 19 BTDC).		
2. Thoroughly cleaned pump and engine around the pump.		
3. Turned off fuel at tank.		
4. Removed all fuel lines to pump, capping lines and connections on pump.		
5. Removed pump from engine following manufacturer's recommended procedures.		
6. Installed new pump by reversing the above procedures.		
7. Checked timing of pump to engine.		
8. Turned on fuel and bleed pump as necessary.		
9. Bled injector lines.		
10. Operated engine to check performance and checked for fuel leaks.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 83

TASK

Replace diesel injector nozzles.

STANDARD OF PERFORMANCE OF TASK

Nozzles must be installed and torqued according to manufacturer's specification, engine must run efficiently and not leak fuel.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine needing fuel injector nozzles replaced
Service manual
Mechanic's tool set
Equipment

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use appropriate mechanic's tools including a torque wrench.
3. State possible symptoms of faulty injectors.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 206-09.

TEACHING ACTIVITIES

1. Have students read and discuss sections on "Diesel Injection Nozzles" and "Bleeding Injection Lines" in textbook, **Agricultural Power and Machinery**, pages 206-09.
2. Discuss the significance of cleaning the area around an injector nozzle before removing a nozzle.
3. Have students look up torque specifications for injector mounting bolts.
4. Demonstrate the procedure for replacing an injector, asking questions of students during the process.
5. Have students replace an injector nozzle.

PERFORMANCE OBJECTIVE 83

CRITERION-REFERENCED MEASURE

Questions

1. When replacing an injector nozzle, which component is the least important as far as cleanliness is concerned?
    a. a new injector
    b. torque wrench
    c. old injector
    d. fuel line
2. Nozzles should be tightened
    a. until they feel tight.
    b. until the instructor says "stop."
    c. until specified torque is reached.
    d. as tight as the mechanic can get them.
3. The final check for replacing injector nozzles should be
    a. visual inspection of cold engine.
    b. operate engine and look for leaks.
    c. open-line check.
    d. cracking pressure check using torque wrench.

Answers

1. c
2. c
3. c

Practical Application

Have students replace a diesel fuel injector nozzle according to manufacturer's recommended specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 83 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 83

REPLACING DIESEL INJECTOR NOZZLES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Cleaned around injector to be removed.		
3. Removed injector mounting bolts or nuts.		
4. Using the proper tool removed injector from cylinder head.		
5. Cleaned hole into which the injector was inserted, as needed.		
6. Installed injector and correctly torqued mounting bolts or nuts.		
7. Uncapped and replaced fuel lines leaving fuel inlet line loose.		
8. Bled fuel inlet line as recommended by manufacturer. Tightened fuel inlet line.		
9. Operated engine, checking for performance and fuel leaks.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 84

TASK

Replace fuel pump.

STANDARD OF PERFORMANCE OF TASK

Replace the fuel pump according to the manufacturer's recommended procedures. Operation of the pump after installation must conform to the manufacturer's specifications and pump must not leak.

SOURCE OF STANDARD

Writing Team State of Florida

CONDITIONS FOR PERFORMANCE OF TASK

Machine with a faulty fuel pump
Service manual
Mechanic's tool set
Equipment

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use appropriate mechanic's tools.
3. Describe two basic types of fuel pumps.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**. pp. 283-84.

TEACHING ACTIVITIES

1. Show students samples of different fuel pumps noting similarities and variations between different models.
2. Discuss the significance of the positioning of mechanically operated pumps.
3. Discuss problems often encountered when installing mechanical fuel pumps.
4. Have students find specific information about fuel pump replacement in an appropriate service manual.
5. Have students replace a fuel pump.

PERFORMANCE OBJECTIVE 84

CRITERION-REFERENCED MEASURE

Questions

1. When replacing a mechanical fuel pump, cleanliness is most significant to

   a. appearance.
   b. leak prevention.
   c. pump operation.
   d. making the job easier.

2. In replacing a fuel pump, when should fuel lines be disconnected from the old pump?

   a. before disconnecting pump from engine
   b. after disconnecting pump from engine
   c. just before new gasket is installed
   d. immediately following installation of new gasket

3. What is most likely to happen if a gasket is not installed between a fuel pump and engine?

   a. fuel leak
   b. engine oil leak
   c. pump won't pump
   d. engine won't run

Answers

1. b
2. a
c. b

Practical Application

Have students replace a mechanical fuel pump according to manufacturer's specifications so that the pump will not leak.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 84 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 84

REPLACING FUEL PUMP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual, noting safety procedures.		
2. Disconnected fuel lines from fuel pump.		
3. Removed mounting bolts holding fuel pump.		
4. Installed new mounting gasket on replacement pump.		
5. Checked that mounting surfaces were clean.		
6. Installed replacement pump.		
7. Connected fuel lines.		
8. Started machine and checked for leaks and correct operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 85

TASK

Replace turbocharger.

STANDARD OF PERFORMANCE OF TASK

Unit must be mounted and torqued according to manufacturer's specifications. There must be no oil, vacuum or pressure leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Service manual
Mechanic's tool set
Protective plastic caps

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use appropriate mechanic's tools.
3. Describe the function of a turbocharger.

RESOURCE

Mitchell Automechanics, pp. 190-93.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mitchell Automechanics**, pages 190-93.
2. Discuss the function of a turbocharger.
3. Have students label components on a diagram of a turbocharged engine.
4. Discuss the critical need for an adequate supply of clean oil to turbocharger shaft.
5. Explain why a nick in turbine blades can result in bearing failure.
6. Have students replace a turbocharger unit.

PERFORMANCE OBJECTIVE 85

CRITERION-REFERENCED MEASURE

Questions

1. Turbocharger shaft lubrication is crucial because of

   a. high turbine speed.
   b. low turbine speed.
   c. waste valve operation.
   d. its relation to intake value operation.

2. Which is not performed when replacing or servicing a turbocharger?

   a. cap oil lines
   b. straighten turbine blades
   c. check for leaks
   d. torque bolts

3. Turbo charging results in

   a. increased engine efficiently.
   b. hotter head and exhaust valve operation.
   c. more power for engine size.
   d. all of these.

Answers

1. a
2. b
c. d

Practical Application

Have students replace a turbocharger with a new unit. The unit must be mounted and torqued according to manufacturer's specifications and there must be no oil, vacuum or pressure leaks.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 85 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 85

REPLACING TURBOCHARGER UNIT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual noting safety procedures.		
2. Removed lube oil inlet and return lines.		
3. Placed protective plastic caps on open ends of lube lines.		
4. Disconnected air duct from turbocharger.		
5. Removed mounting bolts.		
6. Removed turbocharger.		
7. Reversed above procedures in mounting new or replacement turbocharger.		
8. Checked operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING CARBURETION AND FUEL SYSTEMS

PERFORMANCE OBJECTIVE 86

TASK

Check and adjust timing on diesel fuel injection pump.

STANDARD OF PERFORMANCE OF TASK

Check and/or adjust the timing according to service manual. Timing of engine to pump must be within the manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Diesel engine with a fuel injection pump needing to be timed
Service manual
Mechanic's tool set
Equipment

ENABLING OBJECTIVES

1. Read and interpret service manual to determine specific timing procedure.
2. Recognize timing marks.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 288.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 288.
2. Discuss the necessity for injection pump timing.
3. Have students write, in their own words, the general procedures to be followed in timing any diesel injection pump.
4. Point out timing covers and timing marks on injection pumps of varying construction.
5. Have students time an injection pump.

PERFORMANCE OBJECTIVE 86

CRITERION-REFERENCED MEASURE

Questions

1. Which is not part of the procedure for timing injection pumps?
   a. position engine
   b. remove timing cover
   c. rotate injection pump
   d. remove injectors

2. Which is the best engine crank position for timing an injection pump?
   a. #1 cylinder at top dead center
   b. #1 cylinder at bottom dead center
   c. position specified by service manual for that engine
   d. #1 cylinder parallel to injector pump

3. If timing marks are out of alignment, it is necessary to rotate the
   a. pump.
   b. cover.
   c. mark.
   d. engine.

Answers

1. d
2. c
3. a or d

Practical Application

Have students time an injection pump so that the engine will operate properly.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 86 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 86

CHECKING AND ADJUSTING DIESEL INJECTION PUMP TIMING

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Followed manufacturer's recommended procedures positioning engine prior to checking pump timing.		
3. Removed timing cover from side of injection pump housing.		
4. Observed timing marks through opening in pump housing.		
5. Loosened pump mounting bolts and rotated pump housing to align marks.		
6. Tightened pump mounting bolts.		
7. Replaced timing cover.		
8. Checked operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

SERVICING COOLING AND LUBRICATION SYSTEMS

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 87

TASK

Rebuild water pump.

STANDARD OF PERFORMANCE OF TASK

Defective part or parts must be replaced, the pump must perform according to service manual or manufacturer's specifications and must not leak.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Water pump needing to be rebuilt
Service manual
Replacement parts
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 112-13.

TEACHING ACTIVITIES

1. Show samples of defective water pump parts.
2. Demonstrate procedures for rebuilding a typical water pump.
3. Have students locate service data for the specific engine.
4. Have students list steps for rebuilding the specific pump they are to repair.
5. Have students rebuild a water pump.

PERFORMANCE OBJECTIVE 87

CRITERION-REFERENCED MEASURE

Questions

1. Leaks around water shaft are prevented by

   a. impeller.
   b. pulley.
   c. seal.
   d. spindle.

2. Clearance between impeller and housing should be

   a. .070".
   b. zero.
   c. .170".
   d. as specified by service manual.

3. End play on water pump shaft must be

   a. 1/2".
   b. as specified by service manual.
   c. non-existent.
   d. .250".

Answers

1. c
2. d
3. b

Practical Application

Have students rebuild a water pump. The pump must perform according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 87 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 87

REBUILDING A WATER PUMP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual, noting safety procedures.		
2. Removed rear plate from pump.		
3. Disassembled pump according to manufacturer's recommended procedures.		
4. Using new parts reassembled pump according to manufacturer's recommended procedures and specifications.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 88

TASK

Seal leaks in cooling system.

STANDARD OF PERFORMANCE OF TASK

There must be no leaks in cooling system under temperature or pressure changes and the recommended engine temperature must be maintained.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Leaking cooling system
Service manual
Mechanic's tool set
Soldering kit
Plugs
Gaskets and/or seals

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools including a torque wrench.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 194-95.
2. **Mitchell Automechanics**, pp. 208-09.

TEACHING ACTIVITIES

1. Describe and point out on an engine the potential leak areas of the cooling system.
2. Demonstrate the procedure for pressure testing a cooling system.
3. Demonstrate the procedure for cleaning and soldering an area on the radiator.
4. Demonstrate the use of tools for removing and installing freeze plugs.
5. Have students identify, on an engine, the potential areas where cooling system leaks could occur.
6. Have students locate and list specific service data for a specific cooling system.
7. Have students seal a leaking cooling system.

PERFORMANCE OBJECTIVE 88

CRITERION-REFERENCED MEASURE

Questions

1. Cooling systems are checked under pressure because
   a. they operate under pressure.
   b. they operate under negative pressure (vacuum).
   c. radiators only operate when pressure is applied.
   d. the thermostat must be open.

2. When soldering a radiator leak, care must be given to having
   a. metal chew.
   b. metal at correct temperature.
   c. both a and b.
   d. none of these.

3. Gasket mating surfaces are chewed to
   a. prevent old grease from destroying new gasket.
   b. insure a good seal.
   c. keep anti-freeze from eroding the thermostat.
   d. none of these.

Answers

1. a
2. c
3. b

Practical Application

Have students repair a leaking cooling system so that there are no leaks during operation and recommended engine temperature is maintained.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 88 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 88

SEALING LEAKS IN THE COOLING SYSTEM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
Radiator Leakage: 1. Following recommended procedures, removed radiator.		
2. Located leaks by pressure testing.		
3. Cleaned and soldered area needing repair.		
4. Checked repairs by pressure testing.		
5. Reinstalled radiator.		
6. Refilled cooling system.		
Core-Hole Plugs (Freeze plugs): 1. Removed old plug.		
2. Cleaned plug seat, coated with sealing compound on outer edges.		
3. Installed new plug with proper tool.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 88

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
Gaskets: 1. Removed old gasket.		
2. Cleaned gasket mating surfaces.		
3. Installed new gasket.		
4. Used sealing compound, if necessary.		
5. Retorqued attaching bolts.		
Stud bolts and Cap Screws: 1. Removed bolts and screws and cleaned threads.		
2. Applied sealing compound to threads.		
3. Reinstalled and torqued bolts and screws.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 89

TASK

Replace cooling system thermostat.

STANDARD OF PERFORMANCE OF TASK

Engine must perform at manufacturer's recommended temperature + or - 10 F.

SOURCE OF STANDARD

Fundamentals of Service -- Engines, pp. 8-8.

CONDITIONS FOR PERFORMANCE OF TASK

Engine with defective thermostat
Service manual
Thermostat
Mechanic's tool set

ENABLING OBJECTIVES

1. Use basic mechanic's tools.
2. Read and interpret service manual.

RESOURCE

Mitchell Automechanics, pp. 205-06.

TEACHING ACTIVITIES

1. Describe the operation of a cooling system thermostat and its function in the engine.
2. Have students draw and label diagrams showing cooling system operation with the thermostat closed and open.
3. Have students locate the following on an engine (using service manual if necessary): drain cock, thermostat housing, thermostat housing mounting bolts.
4. Have students write the steps in replacing a thermostat to include system checks.
5. Have students replace a thermostat, reinstall coolant and check system operation.

PERFORMANCE OBJECTIVE 89

CRITERION-REFERENCED MEASURE

Questions

1. Operating an engine with no thermostat would result in

    a. improper warm up period.
    b. duel heated engine.
    c. blown freeze plugs.
    d. crushed upper radiator hose.

2. Thermostat should open

    a. when engine cools to a certain point.
    b. when engine heats to a certain point.
    c. when ignition switch is "on."
    d. when cooling system operating pressure is reached.

3. The first step in thermostat replacement would be

    a. get engine to operating temperature.
    b. clean the gasket surfaces.
    c. drain the system.
    d. torque thermostat housing bolts.

Answers

1. a
2. b
3. c

Practical Application

Have students replace cooling system thermostat, install coolant and check system operation. The cooling system should operate according to manufacturer's specification.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 89 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 89

REPLACING A COOLING SYSTEM THEMOSTAT

Student's Name ____________________ Date ____________

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Drained cooling system.		
2. Removed thermostat housing and thermostat.		
3. Cleaned gasket surfaces.		
4. Installed thermostat and housing using new gasket.		
5. Refilled cooling system to proper level with coolant.		
6. Pressure tested system for leaks.		
7. Operated engine until it reached normal operating temperature and rechecked coolant level.		

APPROVED: YES _____ NO _____

Evaluator's Signature ____________________ Date ____________

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 90

TASK

Replace oil cooler.

STANDARD OF PERFORMANCE OF TASK

The system must operate without leaks and maintain the oil temperature specified by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine with faulty oil cooler
Service manual
Mechanic's tool set
New oil cooler

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.

RESOURCE

Shulz. **Diesel Mechanics**, pp. 68-71.

TEACHING ACTIVITIES

1. Discuss the function of an oil cooler.
2. Describe the components of an oil cooler showing these by use of pictures, models or an actual cooler, and describe the functions of each component.
3. Explain the need for cleanliness when removing, servicing or replacing an oil cooler.
4. Have students look up service manual data and list the steps for replacing an oil cooler.
5. Have students replace an oil cooler.

PERFORMANCE OBJECTIVE 90

CRITERION-REFERENCED MEASURE

Questions

1. The first step in replacing any given oil cooler should be to

   a. crank engine.
   b. locate service data for the engine.
   c. position engine to top dead center.
   d. turn off fuel line at tank.

2. Gaskets and oil seals on oil coolers should be replaced

   a. monthly.
   b. daily.
   c. never.
   d. whenever the oil cooler is replaced.

3. The oil cooler

   a. increases oil life.
   b. helps remove heat from the engine.
   c. both a and b.
   d. none of these.

Answers

1. b
2. d
3. c

Practical Application

Have students replace an oil cooler.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 90 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 90

REPLACING OIL COOLER

Student's Name　　　　　　　　Date

DIRECTIONS TO STUDENT　　Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR　　Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Cleaned external surface of cooler and surrounding engine area.		
2. Drained cooler, if possible.		
3. Disconnected lube oil inlet and outlet lines and capped ends of lines.		
4. Removed cooler.		
5. Installed new cooler and reconnected oil lines using new gaskets or seals.		
6. Added oil to crankcase. If necessary.		
7. Operated engine and checked for oil leaks.		
8. Stopped engine, checked oil level and corrected as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature　　　　　　　　Date

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 91

TASK

Replace oil filters.

STANDARD OF PERFORMANCE OF TASK

New filter(s) must be secure and must not leak.

SOURCE OF STANDARD

Fundamentals of Service -- Engines, p. 8-8.

CONDITIONS FOR PERFORMANCE OF TASK

Engine needing the filter(s) replaced
Service manual
Mechanic's tool set
New filter(s)

ENABLING OBJECTIVES

1. Locate oil filter on engine.
2. Read and interpret service manual.
3. Select appropriate tool for loosening/tightening an oil filter.
4. Select appropriate filter for the engine.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 192.

TEACHING ACTIVITIES

1. Discuss the significance of clean engine oil and the need for periodic oil filter replacement.
2. Have students read and discuss section on "Changing Engine Oil" in, **Agricultural Power and Machinery**, page 192.
3. Show models of spin-on and canister/element types of oil filters and discuss appropriate procedures for removing/installing each type
4. Demonstrate procedure(s) for loosening/tightening oil filters.
5. Discuss problems encountered when tightening too much or not enough.
6. Have students replace an oil filter.

PERFORMANCE OBJECTIVE 91

CRITERION-REFERENCED MEASURE

Questions

1. After changing an oil filter, an operational check lets the mechanic know

   a. if the filter works.
   b. if the filter/engine connection leaks.
   c. if the filter is too tight.
   d. all of these.

2. An oil filter is most often changed along with what other engine maintenance procedure

   a. oil change.
   b. brake adjustment.
   c. windshield wiper adjustment.
   d. front end alignment.

3. After a spin-on filter contacts engine mating surface, the filter should be tightened how much?

   a. 1 1/2 turn
   b. 1 3/4 turn
   c. at least two more turns
   d. according to filter manufacturer's directions

Answers

1. b
2. a
3. d

Practical Application

Have students change an engine oil filter so that the filter is secure and does not leak.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 91 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 91

CHANGING ENGINE OIL FILTER

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Drained oil from engine, if necessary.		
2. Removed filter following engine manufacturer's procedures.		
3. Installed new filter reversing above procedure.		
4. Added oil necessary to bring to correct level.		
5. Operated engine until oil pressure regulated and check for leaks.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 92

TASK

Replace oil pressure gauge.

STANDARD OF PERFORMANCE OF TASK

The gauge must function according to manufacturer's specifications and indicate an accurate reading.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Service manual
Mechanic's tool set
Replacement oil pressure gauge.

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.

RESOURCE

Mitchell Automechanics, p. 629.

TEACHING ACTIVITIES

1. Describe and discuss the function of the oil pressure gauge.
2. Show models of the two basic types of oil pressure gauges and discuss the differences between the two.
3. Discuss the function and operation of the oil sending unit and its relation to the oil pressure gauge.
4. Have students locate service data for replacing an oil pressure gauge.
5. Have students replace an oil pressure gauge.

PERFORMANCE OBJECTIVE 92

CRITERION-REFERENCED MEASURE

Questions

1. The balanced coil oil pressure gauge system involves
   a. electricity only.
   b. hydraulic pressure only.
   c. both a and b.
   d. none of these.

2. The oil pressure indicator system is usually tested
   a. with the engine running.
   b. with the engine not running.
   c. with engine turning over under starter power.
   d. none of these.

3. The electrical system for reporting engine oil pressure to the operator includes a gauge and a
   a. regulator.
   b. sending unit.
   c. reservoir.
   d. accumulator.

Answers

1. c
2. a
3. b

Practical Application

Have students replace an oil pressure gauge.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 92 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 92

REPLACING AN OIL PRESSURE GAUGE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Disconnected oil line, or electrical connection from gauge.		
2. Removed gauge mounting bracket.		
3. Removed gauge from instrument panel.		
4. Reinstalled reversing above procedure.		
5. Started engine and checked gauge operation against test gauge installed at manufacturer's test port.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

PERFORMANCE OBJECTIVE 93

TASK

Replace oil pumps.

STANDARD OF PERFORMANCE OF TASK

The pump must perform to manufacturer's specifications with no leaks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine with faulty oil pump
Service manual
New oil pump
Mechanic's tool set

ENABLING OBJECTIVES

1. Use basic mechanics tools.
2. Read and interpret service manual.
3. Recognize causes of oil pump failure.

RESOURCES

1. **Mitchell Automechanic**, pp. 196-99.
2. Toboldt and Johnson. **Automotive Encyclopedia**, p. 106.

TEACHING ACTIVITIES

1. Discuss causes of oil pump failure.
2. Show diagrams or samples of oil pump components.
3. Have students locate manufacturer's information for the oil pump of a specific engine.
4. Have students write, in their own words the steps for replacing an oil pump for a specific engine.
5. Have students replace an oil pump.

PERFORMANCE OBJECTIVE 93

CRITERION-REFERENCED MEASURE

Questions

1. What type of pump is normally used to pump engine oil?

   a. centrifugal
   b. jet
   c. gear
   d. piston

2. Oil is essential to engine life because it

   a. separates moving parts.
   b. reduces wear between moving parts.
   c. both a and b.
   d. none of these.

c. In replacing an oil pump which of these steps would be completed first?

   a. remove oil pan
   b. remove oil pump
   c. drain engine oil
   d. inspect pump to determine cause for damage

Answers

1. c
2. c
3. c

Practical Application

Have students replace an oil pump according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 93 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 93

REPLACING AN OIL PUMP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Drained oil from oil pan.		
2. Removed oil pan and/or other parts to gain access to oil pump.		
3. Removed oil pump and examined to determine reason for failure before replacing with new pump.		
4. Installed replacement pump and reversed the above procedures.		
5. Tested running engine for correct operation of oil pump at rated pressure.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 94

TASK

Replace radiator.

STANDARD OF PERFORMANCE OF TASK

Radiator must not leak upon completion of installation.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Vehicle needing the radiator replaced
Service manual
Mechanic's tool set
Radiator

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanics tools.

RESOURCE

Mitchell Automechanics, pp. 202-03.

TEACHING ACTIVITIES

1. Discuss the function of the radiator as part of the cooling system.
2. The instructor will describe conditions that warrant replacement of a radiator (showing samples of defective radiator).
3. The instructor will demonstrate procedures for pressure testing a radiator for leaks.
4. Have students look up service manual information for the engine to be serviced.
5. Have students list the steps for replacing the radiation, in proper sequence.
6. Have students replace the radiator.

PERFORMANCE OBJECTIVE 94

CRITERION-REFERENCED MEASURE

Questions

1. The primary function of the radiator is to

   a. allow coolant to transfer heat to the air.
   b. allow air to transfer heat to coolant.
   c. increase the operating temperature of the coolant.
   d. store coolant for the cooling system.

2. Radiator fins serve to

   a. strengthen the radiator.
   b. direct air flow over the engine.
   c. increase surface area of radiator.
   d. keep insects from reaching the engine block.

3. In replacing a radiator the first step would be to

   a. pressure test system.
   b. replace hoses.
   c. refill radiator with coolant.
   d. drain coolant from system.

Answers

1. a
2. c
3. d

Practical Application

Have students replace a radiator. The radiator will not leak upon completion of installation.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 94 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 94

REPLACING A RADIATOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Drained coolant from engine.		
2. Removed upper and lower radiator hoses.		
3. Removed mounting bolts and removed old radiator.		
4. Installed radiator, replacing mounting bolts.		
5. Replaced upper and lower radiator hoses.		
6. Refilled radiator with coolant.		
7. Pressure tested for leaks.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 95

TASK

Replace water pump.

STANDARD OF PERFORMANCE OF TASK

Pump must circulate coolant at the manufacturer's specified rate and not leak.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine needing the water pump replaced
New or rebuilt water pump
Service manual
Mechanic's tool set
Gasket
Coolant

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.

RESOURCE

Mitchell Automechanics, p. 207.

TEACHING ACTIVITIES

1. Discuss the function of the water pump as a part of the cooling system.
2. Discuss, using actual models if possible, the reasons why water pumps need to be replaced.
3. Demonstrate procedures for pressure testing a cooling system.
4. Have students locate appropriate service manual information for replacing a water pump.
5. Have students list the steps in sequence for replacing a water pump.
6. Have students replace a water pump.

PERFORMANCE OBJECTIVE 95

CRITERION-REFERENCED MEASURE

Questions

1. A good indication that a water pump needs replacing is
    a. excessive pressure in cooling system.
    b. leaking water pump seal.
    c. loose fan belt.
    d. radiator boil-over.

2. The water pump
    a. forces thermostat to close.
    b. circulates coolant throughout the system.
    c. turns the fan.
    d. helps maintain engine timing.

3. The first step in replacing a water pump would be to
    a. drain cooling system.
    b. check thermostat operation.
    c. clean gasket mating surfaces.
    d. disconnect lower radiator hose at pump.

Answers

1. b
2. b
3. a

Practical Application

Have students replace a water pump according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 95 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 95

REPLACING A WATER PUMP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Drained cooling system.		
2. Disconnected lower radiator hose at pump.		
3. Removed fan, fan pulley and fan hub.		
4. Disconnected pump bypass hose (if equipped).		
5. Removed water pump.		
6. Cleaned block surface of all old gaskets.		
7. Using new gasket, installed new pump using reverse of above procedures.		
8. After coolant had been replaced, pressure tested system, inspecting for leaks and proper coolant level.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING COOLING AND LUBRICATION SYSTEMS

PERFORMANCE OBJECTIVE 96

TASK

Rebuild oil pump.

STANDARD OF PERFORMANCE OF TASK

Rebuild the oil pump according to recommended procedures. Faulty components must be identified and repaired or replaced and pump must perform to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Malfunctioning oil pump
Service manual
Replacement parts
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.

RESOURCE

Mitchell Automechanics, pp. 196-98.

TEACHING ACTIVITIES

1. Discuss causes of oil pump wear and failure.
2. Show samples of worn oil pump components.
3. Demonstrate how to check clearances and measurements in an oil pump.
4. Have students locate appropriate data in a service manual for rebuilding a specific oil pump.
5. Have students list, in sequence, the proper steps for rebuilding a specific oil pump.
6. Have students rebuild a specific oil pump.

PERFORMANCE OBJECTIVE 96

CRITERION-REFERENCED MEASURE

Questions

1. The oil pump must supply sufficient oil pressure at

   a.. high speed.
   b. low or idle speeds.
   c. both a and b.
   d. none of these.

2. Excessive oil pressure buildup is prevented by

   a. oil galleries.
   b. oil pan.
   c. pickup screen.
   d. relief valve.

3. The final step in rebuilding an oil pump would be to

   a. check clearances.
   b. drain oil from system.
   c. clean components.
   d. test pump for rated pressure.

Answers

1. c
2. d
3. d

Practical Application

Have students rebuild an oil pump, identifying and replacing faulty components. The pump must perform according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 96 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 96

REBUILDING AN OIL PUMP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual noting safety procedures.		
2. Cleaned components as necessary.		
3. Disassembled oil pump.		
4. Examined components, checked clearances and measurements to determine cause of failure and defective components.		
5. Reassembled pump with new components according to manufacturer's specifications and instructions.		
6. Tested pump for rated pressure.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

SERVICING ELECTRICAL SYSTEMS

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 97

TASK

Adjust voltage regulator.

STANDARD OF PERFORMANCE OF TASK

Voltage regulator must be set so that output conforms to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Voltage regulator
Voltmeter
Ammeter
Variable resistor
3/4-ohm fixed resistor
Technical service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.
3. Use a voltmeter and an ammeter and properly interpret readings.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 371-73.

TEACHING ACTIVITIES

1. Discuss the function of the voltage regulator and the necessity for proper adjustment.
2. Discuss electrical resistance and describe how a fixed resistor can be used to make proper voltage regulator adjustments.
3. Demonstrate the fixed resistance method for adjusting a voltage regulator, explaining each step of the process.
4. Have students look up service manual data and record proper steps in the process for a specific voltage regulator.
5. Have students adjust a voltage regulator using the fixed resistance method.

PERFORMANCE OBJECTIVE 97

CRITERION-REFERENCED MEASURE

Questions

1. The purpose of the voltage regulator is

    a. to prevent charging voltage from exceeding a predetermined safe value.
    b. to control the amount of electrical pressure available from the battery.
    c. to equalize voltage and amperage in the charging circuit.
    d. all of these.

2. Opposition to the flow of electricity is called

    a. voltage.
    b. amperage.
    c. resistance.
    d. hertz.

3. The voltage setting is changed by

    a. adjusting the length of the wire to the generator.
    b. turning an adjusting screw.
    c. varying the speed of the generator or alternator.
    d. none of these.

Answers

1. a
2. c
3. b

Practical Application

Have students adjust a voltage regulator using the fixed resistance method.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 97 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 97

ADJUSTING VOLTAGE REGULATOR USING THE FIXED RESISTANCE METHOD

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 % is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for specifications and procedure.		
2. Inserted a 1/4-ohm fixed resistor into the charging circuit at the battery terminal.		
3. Connected a voltmeter from the battery terminal to ground.		
4. Cycled the generator by one of two methods: a. Slowed it until voltage drops about one-fourth of rated value; then increased speed and noted the reading. b. Cycled the generator by inserting a variable resistance into the field circuit. Slowly increased resistance until voltage drops to about one-fourth of rated value. Decreased the resistance and noted the voltage reading.		
5. Adjusted the voltage setting by turning the adjusting screw.		
6. Replaced the cover and cycled the generator after each adjustment.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 97

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
7. Took a reading and adjusted as necessary to conform to manufacturer's specifications.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

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DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 98

TASK

Replace alternator regulator.

STANDARD OF PERFORMANCE OF TASK

Regulator must operate according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Machine needing the regulator replaced
Mechanic's tool set
Service manual
Replacement regulator
Voltmeter

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Attach and read a voltmeter.
3. Use basic mechanics tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** p. 226.

TEACHING ACTIVITIES

1. Have students locate information about regulator replacement in the service manual.
2. Have students read and discuss textbook, **Agricultural Power and Machinery,** page 226.
3. Have students list steps for regulator replacement in proper order.
4. Demonstrate the proper use of a voltmeter.
5. Have students replace an alternator regulator.

PERFORMANCE OBJECTIVE 98

CRITERION-REFERENCED MEASURE

Questions

1. The first step in replacing a regulator would be
    a. read related service manual.
    b. remove bolts holding the regulator.
    c. attach voltmeter.
    d. crimp wires.

2. The new regulator must
    a. allow the alternator to produce at least twelve volts.
    b. not overheat the alternator.
    c. operate according to manufacturer specifications.
    d. show a positive current on the voltmeter.

3. The voltmeter is used in checking the regulator to measure
    a. current flow.
    b. power produced.
    c. electrical pressure.
    d. resistance.

Answers

1. a
2. c
3. c

Practical Application

Have students replace an alternator regulator so that the new regulator will operate according to manufacturer specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 98 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 98

REPLACING AN ALTERNATOR REGULATOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to manufacturer's service manual for specifications.		
2. Disconnected electrical connections according to manufacturer's instructions.		
3. Removed regulator assembly.		
4. Replaced regulator assembly.		
5. Reconnected electrical connections.		
6. Connected voltmeter to battery and brought to specified RPM.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 99

TASK

Replace amperage gauge.

STANDARD OF PERFORMANCE OF TASK

The replaced gauge must function according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Replacement amperage gauge
Mechanic's tool set
Service manual

ENABLING OBJECTIVES

1. Use basic mechanic's tools.
2. Read and interpret service manual.
3. Operate electrical test equipment and interpret results.

RESOURCE

Mitchell Automechanics, p. 629.

TEACHING ACTIVITIES

1. Discuss possible reasons for replacing an amperage gauge.
2. Describe the operation of the amperage gauge.
3. Have students draw a rough diagram showing the placement of the amperage gauge in the charging circuit.
4. Have students look up appropriate service data for an amperage gauge.
5. Have students replace an amperage gauge.

PERFORMANCE OBJECTIVE 99

CRITERION-REFERENCED MEASURE

Questions

1. Another name for an amperage gauge is

   a. voltmeter.
   b. wattmeter.
   c. ammeter.
   d. ohmmeter.

2. The amperage gauge indicates

   a. rate of charge.
   b. the load on the battery.
   c. regulator cutout voltage.
   d. spring tension of the sending unit.

3. In replacing an amperage gauge, which step should come first?

   a. disconnect battery ground cable
   b. start engine
   c. unhook gauge terminals
   d. form hooks on the ends of wires

Answers

1. c
2. a
3. a

Practical Application

Have students replace an amperage gauge which will function according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 99 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 99

REPLACING AN AMPERAGE GAUGE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Disconnected battery ground cable.		
2. Removed wires from terminals on gauge.		
3. Removed gauge from instrument panel.		
4. Installed new gauge in instrument panel.		
5. Reconnected wires to gauge.		
6. Reconnected battery ground cable.		
7. Tested operation of gauge.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 100

TASK

Replace diode.

STANDARD OF PERFORMANCE OF TASK

Diode must sustain no damage to hermetic seal or diode lead. Alternator output must be at the level set by the manufacturer.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical System, p. 4-45.

CONDITIONS FOR PERFORMANCE OF TASK

Alternator
Service manual
Replacement diode
Press
Ohmmeter
Voltmeter
Soldering kit
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanics tools.
3. Use a soldering iron.
4. Use electrical testing equipment.

RESOURCE

Mitchell Automechanics, pp. 279-81.

TEACHING ACTIVITIES

1. Discuss the function of alternator diodes.
2. Demonstrate the use of an ohmmeter to locate defective diode(s).
3. Demonstrate the procedure for getting the diode(s) out of the plate.
4. Have students locate appropriate service information for the alternator being serviced.
5. Have students list, in sequence, the steps to be followed in replacing diode (including location of defective diode).
6. Have students replace one or more diodes.

PERFORMANCE OBJECTIVE 100

CRITERION-REFERENCED MEASURE

Questions

1. A diode is also called a
   a. capacitor.
   b. rectifier.
   c. alternator.
   d. stator.

2. A diode should allow current to flow
   a. both ways.
   b. one way only.
   c. neither a nor b.
   d. either a or b depending on the diode.

3. The diode assembly changes three phase alternator output into
   a. 60 cycle A.C..
   b. D.C.
   c. full wave current.
   d. none of these.

Answers

1. b
2. b
3. b

Practical Application

Have students replace an alternator diode. The repaired alternator will operate according to manufacturer's recommendations.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 100 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 100

REPLACING A DIODE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Disassembled alternator.		
2. Located defective diode,using ohmmeter.		
3. Unsoldered diode leads, using low heat and protecting diode from heat.		
4. Pressed old diode out of the plate.		
5. Pressed new diode into position.		
6. Soldered leads.		
7. Checked diode function.		
8. Reassembled alternator and tested.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 101

TASK

Replace generator brushes.

STANDARD OF PERFORMANCE OF TASK

The center of the brushes must be seated on the commutator as specified by manufacturer.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical Systems, p. 4-18.

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Generator
New brushes
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.

RESOURCE

Jacobs and Harrelll. **Agricultural Power and Machinery**, pp. 222-25.

TEACHING ACTIVITIES

1. Discuss the function of brushes as a component of a generator.
2. Show samples of worn brushes and describe how to determine the need for replacement.
3. Using a partially disassembled generator, demonstrate removal and reinstallation of brushes.
4. Explain why brushes must seat properly on the commutator and demonstrate procedure for seating the brushes. (Caution: Do not use emery cloth or steel wool on the commutator).
5. Have students locate service information for the generator to be serviced.
6. Have students replace generator brushes.

PERFORMANCE OBJECTIVE 101

CRITERION-REFERENCED MEASURE

Questions

1. Brushes should be replaced
   a. when 1/4 of them are worn away.
   b. when the generator is apart for servicing.
   c. when they rub against the commutator.
   d. any of these.

2. The commutator can be cleaned with
   a. emery cloth.
   b. steel wool.
   c. sandpaper.
   d. any of these.

3. In replacing generator brushes, which step would come first?
   a. clean commutator
   b. replace cover band
   c. locate service specifications
   d. install tension clips

Answers

1. b
2. c
3. c

Practical Application

Have students replace generator brushes. Brushes will be seated on the commutator as specified by the manufacturer.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 101 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 101

REPLACING GENERATOR BRUSHES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Checked service manual for specifications.		
2. Cleaned dirt from generator housing.		
3. Removed cover band.		
4. Disconnected the brush wire lead where it connects to the brush holder.		
5. Lifted brush tension clip.		
6. Removed old brushes.		
7. Cleaned commutator with sandpaper; thoroughly wiped clean.		
8. Slipped new brushes in place.		
9. Reconnected brush wire lead and tension clip.		
10. Replaced cover band.		
11. Polarized the generator per manufacturer's specifications.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 102

TASK

Replace alternator heat sink.

STANDARD OF PERFORMANCE OF TASK

The heat sink must be in position as designated by the specific alternator.

SOURCE OF STANDARD

Fundamentals of Service -- Engines, p 4-1.

CONDITIONS FOR PERFORMANCE OF TASK

Alternator with a faulty heat sink
New heat sink
Service manual.
Mechanic's tool set
Soldering kit

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.
3. Properly use a soldering iron.

RESOURCE

Chek-Chart. **Automotive Electrical Systems, Classroom Manual**, pp. 96-100.

TEACHING ACTIVITIES

1. Discuss the function of the heat sink in the alternator and relate this function to various other "Heat Sink" materials in the automobile.
2. Show models or samples of various heat sinks and their locations in alternators.
3. Have students practice identifying heat sinks on various alternators.
4. Have students look up appropriate service data for a specific alternator and list, in order, the steps necessary for removing and replacing a heat sink.
5. Have students replace a heat sink.

PERFORMANCE OBJECTIVE 102

CRITERION-REFERENCED MEASURE

Questions

1. The function of the heat sink is
    a. to keep diodes warm.
    b. to carry heat away from diodes.
    c. to produce friction.
    d. to control the direction of current flow through the diodes.
2. Heat sinks often serve as mounting areas for
    a. diodes.
    b. alternator shaft.
    c. commutator bars.
    d. slip rings.
3. The action of heat sinks has what effect on diodes?
    a. increases their length of service
    b. keeps them cool
    c. prevent damage due to excess heat
    d. all of the above.

Answers

1. b
2. a
3. d

Practical Application

Have students replace the heat sink(s) in an alternator.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 102 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 102

REPLACING HEAT SINK

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed all parts necessary to reach heat sink by following instructions in the manufacturer's service manual.		
3. Unsoldered the leads from the diode to the stator winding.		
4. Unbolted the heat sink assembly.		
5. Bolted new assembly in place.		
6. Soldered leads from the diode to the stator winding.		
7. Reassembled all removed parts.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 103

TASK

Polish commutator.

STANDARD OF PERFORMANCE OF TASK

Commutator must show no corrosion, dirt or oxidation. There must be no foreign material packed between commutator bars.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical Systems, p. 4-15.

CONDITIONS FOR PERFORMANCE OF TASK

Armature
Mechanic's tool set
Metal lathe with mica undercutting attachment

ENABLING OBJECTIVES

1. Select and use appropriate mechanic's tools.
2. Operate a metal lathe with a mica undercutting attachment.

RESOURCE

Delco-Remy. **Generators**, p. 28.

TEACHING ACTIVITIES

1. Discuss the necessity for turning a commutator on a lathe.
2. Explain why mica, if used, must be undercut between the commutator bars.
3. Explain why the use of mica between commutator bars has declined in recent years.
4. Review lathe operation procedures and demonstrate these procedures with a commutator in need of turning.
5. Have students polish a commutator by turning it on a lathe and undercut mica if necessary.

PERFORMANCE OBJECTIVE 103

CRITERION-REFERENCED MEASURE

Questions

1. A dirty commutator is polished to

    a. lower electrical resistance between commutator and brushes.
    b. increase electrical resistance between commutator and brushes.
    c. Increase the life of generator bearings.
    d. provide "play" for the brushes.

2. The use of mica as an insulator between commutator bars has declined in recent years because

    a. it is harder than copper.
    b. it must be undercut periodically.
    c. other inexpensive insulting materials are now available.
    d. all of these.

3. Failure to undercut mica after turning a commutator on a lathe results in

    a. no contact when generator is reassembled between brushes and commutator.
    b. satisfactory brush - commutator contact at first but rapid loss of good contact during operation.
    c. low electrical resistance between commutator and brushes for the life of the brushes.
    d. all of these.

Answers

1. a
2. d
3. b

Practical Application

Have students polish a commutator by turning it on a metal lathe and undercut mica if necessary.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 103 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 103

POLISHING A COMMUTATOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Placed armature in lathe.		
2. Removed only enough material to true and "cleaned up" commutator.		
3. Undercut mica between commutator bars. Approximately 1/64 inch deep and .002 inch wider than mica. (If mica was used as insulator)		
4. Cleaned commutator of all burrs.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 104

TASK

Rebuild distributor.

STANDARD OF PERFORMANCE OF TASK

Faulty components must be identified and repaired or replaced and distributor must conform to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Distributor needing rebuilding
Replacement parts
Service manual
Mechanic's tool set
Test equipment

ENABLING OBJECTIVES

1. Identify the parts of a distributor.
2. Read and interpret service manual.
3. Use basic mechanic's tools.
4. Use electrical test equipment.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 408-17.

TEACHING ACTIVITIES

1. Discuss the function of the distributor as it relates to engine operation.
2. Discuss the reason for rebuilding a distributor.
3. Show models, samples or pictures of typical worn or faulty distributor parts and describe results of each.
4. Have students locate service information for a specific distributor.
5. Have students list in sequence the steps for rebuilding a distributor.
6. Have students rebuild a distributor.

PERFORMANCE OBJECTIVE 104

CRITERION-REFERENCED MEASURE

Questions

1. The distributor is a component of

    a. the primary ignition circuit.
    b. the secondary ignition circuit.
    c. both a and b.
    d. neither a nor b.

2. Dwell may be increased by

    a. decreasing point gap.
    b. increasing point gap.
    c. setting ignition timing.
    d. adjusting valves.

3. Distributor cam lobes

    a. push contact points open.
    b. push contact points closed.
    c. distribute oil to breaker points.
    d. serve as a ground for the primary circuit.

Answers

1. c
2. a
3. a

Practical Application

Have students rebuild a distributor according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 104 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 104

REBUILDING A DISTRIBUTOR

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to manufacturer's service manual for specifications.		
2. Disassembled per manufacturer's instructions.		
3. Repaired or replaced and tested all parts needed to bring distributor to manufacturer's specifications.		
4. Reassembled per manufacturer's specifications.		
5. Tested completed distributor per manufacturer's specifications.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 105

TASK

Rebuild starter.

STANDARD OF PERFORMANCE OF TASK

Starter must be rebuilt to manufacturer's specifications. Faulty components must be identified and repaired or replaced and starter must perform to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Starter needing rebuilding
All parts necessary
Service manual
Mechanic's tool set
Test equipment

ENABLING OBJECTIVES

1. Use electrical test equipment.
2. Use basic mechanic's tools.
3. Read and interpret service manual.

RESOURCE

Mitchell Automechanics, pp. 299-302.

TEACHING ACTIVITIES

1. Show samples, models or pictures of basic starter components.
2. Discuss the functions of basic starter components.
3. Demonstrate bench test procedures for starters.
4. Have students locate appropriate service information for a starter.
5. Have students describe in his own words the bench test procedure for a starter.
6. Have students rebuild a starter.

PERFORMANCE OBJECTIVE 105

CRITERION-REFERENCED MEASURE

Questions

1. Starter armatures may be bench tested successfully using a

   a. ammeter.
   b. voltmeter.
   c. growler.
   d. solenoid.

2. Insufficient starter operating speed may indicate

   a. worn brushes.
   b. shorted commutator.
   c. pitted solenoid contacts.
   d. any of these.

3. Starter field coils are usually tested for

   a. opens.
   b. grounds.
   c. both opens and grounds.
   d. none of these.

Answers

1. c
2. d
3. c

Practical Application

Have students rebuild a starter, replacing faulty components so that the starter will perform according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 105 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 105

REBUILDING A STARTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to manufacturer's service manual for specifications.		
2. Disassembled the starter.		
3. Repaired or replaced and tested all parts.		
4. Reassembled the starter.		
5. Tested completed starter.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 106

TASK

Replace alternator bearings.

STANDARD OF PERFORMANCE OF TASK

When service is complete, the rotor must run freely with no side play.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical System, p. 4-45.

CONDITIONS FOR PERFORMANCE OF TASK

Alternator
New set of bearings
Service manual
Mechanic's tool set
Arbor press

ENABLING OBJECTIVES

1. Use an arbor press effectively and safely.
2. Read and interpret service manual.
3. Use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 222.

TEACHING ACTIVITIES

1. Show samples or models of defective and serviceable alternator bearings.
2. Discuss the function of bearings and the causes for failure.
3. Have students look up appropriate information for replacing an alternator bearing for a specific alternator.
4. Have students list the steps including safety precautions, for replacing the bearings in a specific alternator.
5. Have students replace the bearings in a specific alternator.

PERFORMANCE OBJECTIVE 106

CRITERION-REFERENCED MEASURE

Questions

1. Alternator bearings support

   a. the heat sink.
   b. the diodes.
   c. the slip rings.
   d. the rotor.

2. Alternator bearings should be replaced when

   a. the rotor will not turn freely.
   b. there is side play in the rotor.
   c. the diodes are serviced.
   d. either a or b..

3. A special tool used to remove alternator bearings is

   a. a Phillips screwdriver.
   b. a drill press.
   c. an arbor press.
   d. an ohmmeter.

Answers

1. d
2. d
3. c

Practical Application

Have students replace alternator bearings so that the alternator rotor turns freely with no side play.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 106 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 106

REPLACING ALTERNATOR BEARINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Identified defective bearing.		
2. Disassembled alternator, following instructions in the manufacturer's service manual.		
3. Pressed defective bearing from housing.		
4. Pressed new bearing into housing.		
5. Reassembled alternator.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 107

TASK

Replace distributor points and condenser.

STANDARD OF PERFORMANCE OF TASK

Point gap setting must be set as specified in operator's manual.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical System, p. 6-1.

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Distributor points
Condenser
Service manual
Feeler gauge
Dwell meter
Ignition wrench set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify and use tools appropriate for ignition system service.
3. State procedures for adjusting point gap using a feeler gauge or a dwell meter.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** pp. 210-12.

TEACHING ACTIVITIES

1. Discuss the junction of each component of the primary ignition circuit.
2. Explain the relationship between point gap, dwell and ignition timing.
3. Demonstrate the use of a flat feeler gauge.
4. Demonstrate the connection and use of a dwell meter.
5. Show (on a mockup if possible) how the points open and close and how the point gap is adjusted.
6. Have students read and discuss textbook, **Agricultural Power and Machinery,** pages 210-12.
7. Have students replace and adjust ignition points and condenser.

PERFORMANCE OBJECTIVE 107

CRITERION-REFERENCED MEASURE

Questions

1. A spark is created by the coil at the precise time the points

   a. open.
   b. close.
   c. dwell.
   d. move in either direction.

2. A flat feeler gauge is used to measure point gap when the points are

   a. open.
   b. closed.
   c. operating at normal speed and temperature.
   d. burned.

3. The points are opened by

   a. a spring.
   b. a cam.
   c. electrical impulses.
   d. a notch on the rotor cap.

Answers

1. a
2. b
3. a

Practical Application

Have students replace and adjust distributor points and condenser according to service manual specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 107 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 107

REPLACING/ADJUSTING DISTRIBUTOR POINTS AND CONDENSER

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Referred to operator's manual for specifications.		
2. Took distributor cap off.		
3. Removed breaker arm and spring.		
4. Removed stationary breaker point bracket.		
5. Cleaned, then lubricated cam with distributor cam lubricant.		
6. Removed and replaced condenser.		
7. Installed new points in reverse order of the procedure used to disassemble.		
8. Set breaker points using a feeler gauge; checked with dwell meter.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 108

TASK

Test and replace ignition coil.

STANDARD OF PERFORMANCE OF TASK

The coil must be connected to the power source as specified by manufacturer and there must be no broken or loose leads or connections.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical System, p. 6-1.

CONDITIONS FOR PERFORMANCE OF TASK

Engine ignition coil
Coil tester
Mechanic's tool set

ENABLING OBJECTIVES

1. State the function of the coil in the ignition system.
2. Select and use appropriate tools, including a coil testing instrument.
3. Interpret readings on a coil testing instrument.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** pp. 212-14.

TEACHING ACTIVITIES

1. Discuss the function of the coil.
2. Demonstrate connections, calibration and use of the coil tester.
3. Have students read and discuss the section entitled "Servicing the Coil" in textbook, **Agricultural Power and Machinery,** pages 212-14.
4. Discuss potential coil problems or reasons why an acceptable reading may not be indicated.
5. Have students test and replace a coil.

PERFORMANCE OBJECTIVE 108

CRITERION-REFERENCED MEASURE

Questions:

1. The direction current moves through the coil is called

   a. voltage.
   b. amperage.
   c. polarity.
   d. point setting.

2. Which is a potential coil problem?

   a. reversed polarity
   b. grounded primary circuit
   c. open primary
   d. any of these

3. If either circuit in a coil is shorted or open what is recommended to be done with the coil?

   a. replace it
   b. use a new mounting bracket
   c. recalibrate it
   d. reverse the wires

Answers

1. c
2. d
3. a

Practical Application

Have students test and replace an ignition coil according to manufacturer specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 108 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 108

TESTING AND REPLACING IGNITION COIL

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Removed wires from coil.		
2. Connected coil tester to input and output on coil.		
3. Selected voltage on tester.		
4. Rotated calibration knob to lowest level of power input.		
5. Adjusted pattern length on the tester until one full wave length was displayed.		
6. Rotated calibration knob until a reading of 20KV was reached.		
7. Checked reasons for not reaching 20KV reading, if applicable.		
8. If reverse polarity was noted, switched leads between plus (+) and minus (-) outlets on coil and rechecked.		
9. If shorted-open problems were noted, replaced coil.		
10. Rechecked reading.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 109

TASK

Replace ignition distributor.

STANDARD OF PERFORMANCE OF TASK

The distributor must be timed to the engine and ignition circuit and engine must operate according to manufacturer's specifications.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical Systems, pp. 6-11, 6-16.

CONDITIONS FOR PERFORMANCE OF TASK

Engine requiring replacement of the ignition distributor
Ignition distributor
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Identify components of the distributor.
2. Use ignition test and adjustment equipment.
3. Locate and interpret ignition timing specifications.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 216.

TEACHING ACTIVITIES

1. Have students read and discuss section entitled, "Timing the Ignition System" in textbook, **Agricultural Power and Machinery**, pages 215-16.
2. Have students list in order the steps for replacing a distributor and for resetting ignition timing.
3. Discuss the significance of the rotor position when installing a distributor.
4. Demonstrate the use of a timing light and dwell meter to adjust ignition timing.
5. Have students replace a distributor.

PERFORMANCE OBJECTIVE 109

CRITERION-REFERENCED MEASURE

Questions

1. Failure to position a new distributor correctly will result in

   a. early ignition.
   b. late ignition.
   c. either a or b.
   d. neither a nor b.

2. When timing an engine, the timing light should be directed at

   a. speedmeter.
   b. timing marks.
   c. dwell meter dial.
   d. breaker points.

3. Ignition timing is affected by

   a. rotating the distributor.
   b. changing point dwell.
   c. both a and b.
   d. neither a nor b.

Answers

1. c
2. b
3. c

Practical Application

Have students replace an ignition distributor so that the engine operates properly.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 109 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 109

REPLACING IGNITION DISTRUBUTOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Removed primary and secondary ignition wires from distributor.		
2. Checked and marked position of rotor.		
3. Loosened mounting bolts and removed distributor.		
4. Installed new distributor. Rotor must be in the same position as it was in the old distributor.		
5. Reconnected primary and secondary ignition wires.		
6. Set ignition timing, using a timing light.		
7. Set breaker points, using a dwell meter.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 110

TASK

Replace ignition wires.

STANDARD OF PERFORMANCE OF TASK

Wire size and resistance reading must meet manufacturer's specifications. The replaced wires must be connected to the distributor and spark plugs as indicated in the service manual.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical System. p. 6-1, 6-6.

CONDITIONS FOR PERFORMANCE OF TASK

Engine in which ignition wires need to be replaced
Service manual
Mechanic's tool set
Ignition wires

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.
3. Identify the location of each cylinder number on the engine to be serviced.

RESOURCE

Mitchell Automechanics, p. 381.

TEACHING ACTIVITIES

1. Discuss the significance of secondary ignition wires and describe the damage which may occur if handled improperly.
2. Using a spark plug wire puller, demonstrate the procedure for disconnecting a spark plug wire and boot.
3. Discuss visual checks of spark wires.
4. Demonstrate resistance checks of spark plug wires.
5. Demonstrate cutting length and installing terminal and dust covers on ignition wire.
6. Have students look up and record the firing order and direction of distributor rotation for the engine to be serviced.
7. Have students remove and replace spark plug wires in appropriate locations.

PERFORMANCE OBJECTIVE 110

CRITERION-REFERENCED MEASURE

Questions

1. Before removing a spark wire from a spark plug we should
   - a. start the engine.
   - b. grab the wire anywhere and yank.
   - c. twist the boot.
   - d. loosen the spark plug.
2. Spark plug wires may be checked visually in which of the following procedures?
   - a. resistance test
   - b. carbon-pile test
   - c. carbon teaching boot test
   - d. manufacturer's firing order specification test
3. The conductor in a spark plug wire is usually
   - a. a solid copper wire.
   - b. a stranded copper wire alloy.
   - c. carbon coated threads.
   - d. copper/silver alloy paste.

Answers

1. c
2. a
3. c

Practical Application

Have students replace secondary ignition wires, sizing and connecting them according to engine manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 110 to determine if assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 110

REPLACING SECONDARY IGNITION WIRES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Determined distributor rotation and firing order.		
2. Removed and numbered spark plug wires.		
3. Cut new wires to specified length or resistance as required by the manufacturer.		
4. Installed dust covers and terminals; crimped in place.		
5. Reinstalled wires beginning with No. 1 plug; continued in firing order until completed.		
6. Checked for proper operation.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 111

TASK

Replace starter armature shaft bushing.

STANDARD OF PERFORMANCE OF TASK

The bushings must be installed without damage, and the starter must operate according to manufacturer's specifications with no armature drag.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical System, p. 5-27.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Puller
Driver set
Service manuals
Starter

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.
3. Use electrical testing equipment.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia,** pp 395-96.

TEACHING ACTIVITIES

1. Show models of worn starter shaft bushings, pointing out the poor fit between a new shaft and the worn bushing.
2. Discuss general procedures to be followed before taking a starter apart.
3. Demonstrate procedures for removing and installing bushings in the housing without damage to the bushing or housing.
4. Have students locate appropriate service data for a specific starter to be serviced and list the steps for replacing the bushings on that specific starter.
5. Have students replace armature shaft bushings on a specific starter.

PERFORMANCE OBJECTIVE 111

CRITERION-REFERENCED MEASURE

Questions

1. The starter housing is held together by

   a. solenoid screws.
   b. bushing drive plate.
   c. through bolts.
   d. none of these.

2. Before inserting the armature shaft into new bushings, the mechanics must

   a. rewire the solenoid.
   b. grease the puller tool.
   c. grind the armature shaft to proper size.
   d. lubricate the bushing.

3. The starter housing is cleaned before disassembly mainly to

   a. reduce chances of getting dirt or grease on internal parts.
   b. improve the starter's appearance.
   c. give mechanic's helper something to do.
   d. uncover vital information on the solenoid housing.

Answers

1. c
2. d
3. a

Practical Application

Have students replace armature shaft bushings in a starter without damage to the starter or components. The starter will operate with no drag according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 111 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 111

REPLACING STARTER ARMATURE SHAFT BUSHING

Student's Name ______________________ Date ______________________

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Cleaned exterior of starter.		
3. Removed solenoid.		
4. Removed through bolts.		
5. Removed drive end of housing.		
6. Removed armature.		
7. Removed bushing with appropriate puller or driver.		
8. Inspected housing and shaft.		
9. Installed new bushings with appropriate driver.		
10. Lubricated the bushings.		
11. Reassembled the starter.		
12. Tested on bench with proper power supply.		

APPROVED: YES _____ NO _____

Evaluator's Signature ______________________ Date ______________________

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 112

TASK

Replace starter brushes.

STANDARD OF PERFORMANCE OF TASK

The starter must operate as specified by manufacturer.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical Systems, p. 5-27.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Starter
Replacement brushes

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 393-96.

TEACHING ACTIVITIES

1. Show samples or models of worn starter brushes explaining the general procedures involved in determining if brushes need to be replaced.
2. Point out the basic components (on a starter or model) that must be identified and manipulated during brush removal and installation.
3. Explain how to determine, by visual inspection, the need for additional repair, such as commutator or retainer damage.
4. Have students locate service data for a specific starter and list, in their own words, necessary steps for brush replacement.
5. Have students replace a set of starter brushes.

PERFORMANCE OBJECTIVE 112

CRITERION-REFERENCED MEASURE

Questions

1. Brushes are held in contact with the commutator by the

   a. spring.
   b. bendix.
   c. through bolt.
   d. pole shoe.

2. Brushes serve what purpose?

   a. They keep internal starter component free of dust.
   b. They hold commutator in perfect alignment.
   c. They provide electrical connection between the armature and external circuits.
   d. They keep adequate tension on the pole shoe and sleeve.

3. A broken brush spring might result in

   a. inadequate starter operation.
   b. poor contact between brush and commutator.
   c. an open circuit in the starter.
   d. any of these.

Answers

1. a
2. c
3. d

Practical Application

Have students replace starter brushes. The starter must operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 112 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 112

REPLACING STARTER BRUSHES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed cover over brushes.		
3. Cleaned components as necessary.		
4. Removed all brushes from retainers.		
5. Removed end-plate.		
6. Inspected commutator and retainers for damage.		
7. Installed new brushes.		
8. With hook, pulled back on the brush springs and inserted brushes into their holders.		
9. Slid in end-plate.		
10. Covered brushes.		
11. Checked operation with battery.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 113

TASK

Replace starter drive assembly.

STANDARD OF PERFORMANCE OF TASK

The drive must react instantly and freely when starter is activated.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Starter drive
Specified lubricant
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's hand tools effectively.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 391-94.

TEACHING ACTIVITIES

1. Show models or samples of several of the basic types of starter drive systems, explaining the operation of each.
2. Discuss the function of starter drives before, during, and after the actual cranking operation, including potential problems.
3. Point out the names of the various components involved in replacement of a starter drive assembly.
4. Have students locate appropriate service data for a specific starter drive and record the proper steps for removing and replacing the drive mechanism.
5. Have students replace a starter drive assembly.

PERFORMANCE OBJECTIVE 113

CRITERION-REFERENCED MEASURE

Questions

1. The basic function of a starter drive assembly is to

   a. activate the solenoid.
   b. apply tension to the spring.
   c. engage/disengage the starter and flywheel teeth.
   d. none of these.

2. When an engine begins to operate on its own power, the flywheel teeth and the starter teeth should

   a. engage.
   b. disengage.
   c. clash momentarily.
   d. remain together and turn while the engine is running.

3. When engaged, what is the approximate ratio of the starter drive gear RPM to the flywheel RPM?

   a. 1:1
   b. 2:1
   c. 15:1
   d. 30:1

Answers

1. c
2. b
3. c

Practical Application

Have students replace a starter drive assembly. Upon completion, the drive will react instantly and freely.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 113 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 113

REPLACING STARTER DRIVE ASSEMBLY

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Cleaned exterior of starter.		
3. Removed through bolts.		
4. Removed retaining ring.		
5. Removed old drive.		
6. Inspected shaft for wear.		
7. Lubricated starter drive shaft with specified lubricant.		
8. Installed new drive and retaining ring.		
9. Reassembled starter.		
10. Checked the drive for operation on the bench.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 114

TASK

Replace starter motor.

STANDARD OF PERFORMANCE OF TASK

The starter must be installed and operate according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Replacement starter
Service manual
Machine needing starter

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's hand tools.
3. Use electrical diagnostic equipment.

RESOURCE

Toboldt and Johnson. **Automotive Encyclopedia**, pp. 396-400.

TEACHING ACTIVITIES

1. Discuss the reasons for removing and reinstalling a starter motor.
2. Show and discuss models or samples of the basic starter mounting methods.
3. Demonstrate procedures for testing the operation of a starter on the vehicle.
4. Have students look up service data for replacing a starter on a specified engine, recording the steps to be followed in their own words.
5. Have students remove and replace a starter motor and perform operational tests on the engine.

PERFORMANCE OBJECTIVE 114

CRITERION-REFERENCED MEASURE

Questions

1. Starter motors are almost always removed from the engine for servicing. (true or false)

2. Starter motors are always mounted in the same location and in the same manner on all engines. (true or false)

3. Safe removal and replacement of a starter includes disconnecting one or more battery cable connections. (true or false)

Answers

1. true
2. false
3. true

Practical Application

Have students replace a starter motor. The newly installed starter must operate according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 114 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 114

REPLACING STARTER MOTOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed battery ground cable.		
3. Removed wires to starter.		
4. Removed starter bolts.		
5. Removed starter.		
6. Installed starter.		
7. Tightened starter bolts.		
8. Reconnected wires to starter.		
9. Reconnected ground cable.		
10. Tested starter.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 115

TASK

Replace starter motor solenoid.

STANDARD OF PERFORMANCE OF TASK

The solenoid must be installed according to manufacturer's procedures. Wires must be properly routed and electrical connections must be secure.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Solenoid
Machine needing a starter solenoid
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Use basic mechanic's tools.
3. Use electrical diagnostic equipment.

RESOURCE

Mitchell Automechanics, pp. 301-02.

TEACHING ACTIVITIES

1. Discuss the operating function of the starter solenoid.
2. Demonstrate bench tests and inspection of a solenoid.
3. Demonstrate bench testing of a defective solenoid and compare the operation with a "good" solenoid.
4. Have students look up service data for a specific starter and list the steps for removing, replacing and testing the solenoid.
5. Have students remove, replace and test the operation of a solenoid according to manufacturer's recommendations.

PERFORMANCE OBJECTIVE 115

CRITERION-REFERENCED MEASURE

Questions

1. The starter solenoid operates on what basic principle?
    a. hydraulic pressure
    b. gravity
    c. inertia
    d. electro magnetic force

2. The starter solenoid plunger is returned to "at rest" position by
    a. the pull of "at rest" windings.
    b. inertia.
    c. gravity.
    d. spring tension.

3. When replacing a solenoid, proper pinion travel clearance can be determined by
    a. consulting the appropriate service data.
    b. checking the operator's manual.
    c. measuring "play" between the flywheel ring gear and the starter drive gear.
    d. any of these.

Answers

1. d
2. d
3. a

Practical Application

Have students replace a starter solenoid, performing bench and operational tests.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 115 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 115

REPLACING A STARTER SOLENOID

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted repair manual.		
2. Disconnected battery ground cable.		
3. Removed the starter wires.		
4. Removed the starter.		
5. Removed the solenoid from the starter.		
6. Installed the new solenoid on the starter.		
7. Bench tested.		
8. Reinstalled starter and reconnected wires.		
9. Reconnected battery ground cable.		
10. Started machine and checked for proper operation of solenoid.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 116

TASK

Set breaker point dwell.

STANDARD OF PERFORMANCE OF TASK

The dwell must be set to the angle specified in the manual.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical Systems, p. 6-15.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Machine with points
Dwell meter

ENABLING OBJECTIVES:

1. Read and interpret service manual.
2. Select and use basic mechanic tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, pp. 431-35.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 431-35.
2. Show a schematic of an engine to students.
3. Explain how to mark the location of the rotor on the distributor cap.
4. Illustrate the proper procedure to adjust the point gap.
5. Describe the procedure of replacing the rotor and distributor cap.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 116

CRITERION-REFERENCED MEASURE

Questions

1. __________ points are often the cause of weak sparks.
2. One should use a ________ gauge to determine the point gap.
3. Turn the distributor shaft until the arm is on the ______ point of the cam to adjust the gap.

Answers

1. Dirty
2. feeler
3. high

Practical Application

Have students set the breaker point dwell according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 116 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 116

SETTING BREAKER POINT DWELL

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Referred to operator's manual for specifications.		
2. Turned engine until cam opens breaker points to widest position.		
3. Checked points for proper spacing, using a feeler gauge.		
4. Loosened lock screw on bracket, if adjustment was necessary.		
5. Adjusted points for proper alignment and spacing.		
6. Tightened lock screw on bracket.		
7. Rechecked gap between points and wiped clean.		
8. Checked and made final adjustments using the dwell meter.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 117

TASK

Set ignition timing.

STANDARD OF PERFORMANCE OF TASK

The timing must be set as specified in the manual.

SOURCE OF STANDARD

Fundamentals of Service -- Electrical Systems, p. 6-16.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Operator's manual
Timing light
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, pp. 433-37.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 433-37.
2. Show students how to find top dead center of the number one cylinder.
3. Illustrate to students the procedure of aligning the flywheel marks to determine the position of the piston on the compression stroke.
4. Discuss with students the proper way to connect and use the timing light.
5. Explain to students why it is essential to properly time the engine.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 117

CRITERION-REFERENCED MEASURE

Questions

1. If an engine is timed too fast it may _______.
2. Before an engine can be timed, one cylinder must be on _______ _______.
3. The timing of the distributor determines when the _______ is supplied.

Answers

1. knock
2. dead center
3. spark

Practical Application

Have students set the ignition timing to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 117 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 117

SETTING IGNITION TIMING

Student's Name ____________ **Date** ____________

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Checked operator's manual for specifications.		
2. Located timing marks on flywheel or fan pulley.		
3. Connected timing light as recommended by manufaturer.		
4. Determined from operator's manual what timing mark to use with light, and corrected engine RPM.		
5. Chalked the timing mark so it is easily seen.		
6. Started engine and ran it at speed recommended in operator's manual.		
7. Directed timing light at markings on flywheel or on fan pulley.		
8. Loosened clamps that held distributor.		
9. Turned distributor body slightly until recommended timing mark was opposite the pointer.		
10. Tightened distributor.		
11. Rechecked timing after tightening.		
12. Removed timing light.		
13. Replaced cover over timing hole, if removed.		

APPROVED: YES ____ NO ____

Evaluator's Signature ____________ **Date** ____________

DUTY SERVICING ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE 118

TASK

Troubleshoot electrical system.

STANDARD OF PERFORMANCE OF TASK

The system must be checked completely and all troubles must be recorded.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Test equipment

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools and test equipment.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 218-27.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 218-27.
2. Explain to students the importance of proper safety procedures with batteries.
3. Discuss with students the way the electrical system works.
4. Illustrate to students the procedure of tracing the electrical system path.
5. Demonstrate to students the proper procedure in operating electrical test equipment.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 118

CRITERION-REFERENCED MEASURE

Questions

1. The ________ should be the first electrical component checked.
2. Remove the battery ________ cable before servicing the electrical system.
3. Never operate any alternator with an ________ circuit.

Answers

1. battery
2. ground
3. open

Practical Application

Have students troubleshoot a typical electrical malfunction.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 118 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 118

TROUBLESHOOTING ELECTRICAL SYSTEM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted manual for varying procedures.		
2. Asked the machine operator for symptoms.		
3. Visually inspected electrical system.		
4. Began at battery and traced system.		
5. Recorded problems as they were located.		
6. Disconnected any component that might have damaged the system.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

SERVICING INTERNAL COMBUSTION ENGINES

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 119

TASK

Install connecting rod caps.

STANDARD OF PERFORMANCE OF TASK

The bearings must be seated as specified in the service manual. There must be no damage to crankshaft.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Micrometers
Plastigage
Soft-faced hammer

ENABLING OBJECTIVES

1. Select and use basic mechanic's tools.
2. Interpret a Micrometer.
3. Read and interpret service manual.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 284-85.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 284-85.
2. Show students a schematic of a connecting rod.
3. Explain to students the purpose of a Plastigage.
4. Demonstrate to students the proper method in checking bearing running clearance.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 119

CRITERION-REFERENCED MEASURE

Questions

1. One should use _______ to check bearing running clearance.
2. One should check the _______ _________ for recommended running clearance.
3. Bearings become round when properly _______ on the crankshaft.

Answers

1. Plastigage
2. service manual
3. torqued

Practical Application

Have students install a connecting rod cap according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 119 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 119

INSTALLING CONNECTING ROD CAPS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed all parts necessary to make piston and crankshaft accessible.		
2. Unbolted rod cap.		
3. Tapped cap loose from rod with a soft-faced hammer.		
4. Removed cap, noting its position for reassembly.		
5 Pushed rod away from crankshaft, taking care not to scratch crankshaft journal.		
6 Measured journal for excess wear.		
7. Pried insert from rod and rod cap.		
8. Installed new inserts in the same piston.		
9. Oiled bearings lightly with engine oil.		
10. Reseated rod on crankshaft journal.		
11. Reinstalled rod cap.		
12. Torqued to specifications (to set inserts).		
13. Removed cap and placed a strip of Plastigage across the insert.		
14. Replaced cap and torqued to specifications.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 119

INSTALLING CONNECTING ROD CAPS

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
15. Removed cap and measured Plastigage width using card that came with the Plastigage.		
16. If clearance was within specified limits, cleaned Plastigage from insert and journal.		
17. Bent up lock tabs or installed lock wires as required.		
18. Reassembled engine.		

APPROVED: YES ______ NO

Evaluator's Signature Date

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 120

TASK

Install crankshaft.

STANDARD OF PERFORMANCE OF TASK

The crankshaft must be installed according to manufacturer's specifications without damage to crankshaft journals or bearings surfaces. Crankshaft must operate without binding.

SOURCE OF STANDARD

Writing Team State of Florida

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Mechanic's tool set
Lubricant
New main bearings
Micrometer
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 281-83.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 281-83.
2. Explain to students the importance of bearing clearance.
3. Illustrate to students the proper application of Plastigage to crankshaft journals.
4. Assemble the crankshaft properly.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 120

CRITERION-REFERENCED MEASURE

Questions

1. Fingerprints can cause _______ on bearing surfaces.
2. Be sure that the bearing bores and caps are free from _____.
3. Failure to install bearings in the proper locations can result in _____ _____ to vital engine parts.

Answers

1. corrosion
2. oil
3. oil stoppage

Practical Application

Have students install a crankshaft according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 120 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 120

INSTALLING A CRANKSHAFT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specifications.		
2. Tore down engine.		
3. Removed connecting rods and pistons. Noted the number of rods and proper position for reassembly.		
4. Removed main bearing caps. Noted position and order of caps.		
5. Measured crankshaft for worn journals.		
6. Installed inserts in block and main bearing cap.		
7. Lubricated all bearings.		
8. Placed crankshaft in block.		
9. Replaced main bearing caps in original order.		
10. Torqued each cap to manufacturer's specifications.		
11. Turned crankshaft a few turns by hand to check for binding.		
12. Reversed tear down procedure.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 121

TASK

Install main bearings and caps.

STANDARD OF PERFORMANCE OF TASK

All main cap bolts must be torqued, and clearances measured to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Bearings and cap
Mechanic's tool set
Service manual
Plastigage
Engine oil

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 281-82.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 281-82.
2. Explain to students the importance of torquing main caps.
3. Show a schematic of the main bearing and caps.
4. Illustrate to students the proper method of marking bearings and caps.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 121

CRITERION-REFERENCED MEASURE

Questions

1. If bearings are handled too much, _____ can cause corrosion.
2. When torquing bolts or nuts one should torque them in _____.
3. You should use engine oil or _____ _____ base lubricant on bearings before installing them.

Answers

1. fingerprints
2. stages
3. white - lithium

Practical Application

Have students install main bearings and caps according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 121 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 121

INSTALLING MAIN BEARINGS AND CAPS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed crankshaft. Marked all parts for proper reassembly.		
3. Removed main bearings and rod bearings.		
4. Installed inserts in block for main bearings.		
5. Installed new main and rod bearings.		
6. Installed inserts in main caps.		
7. Lubricated inserts with engine oil.		
8. Put crankshaft in place and installed main caps.		
9. Torqued all main cap bolts.		
10. Removed front main cap and placed a strip of Plastigage across the full width of insert.		
11. Installed and torqued cap.		
12. Removed cap and measured Plastigage (at front, center, and back of insert).		
13. If clearance was not to specification, corrected it with over- or under-sized insert and checked again.		
14. When clearance is correct, cleaned Plastigage off insert and journal. Replaced and torqued caps.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 121

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
15. Repeated for each additional main bearing.		
16. Turned crankshaft by hand to make sure it did not bind.		
17. Installed number 1 piston rod.		
18. Installed inserts and rod cap and checked clearance as shown previously.		
19. Turned crankshaft by hand to check for binding.		
20. Followed the same procedure for each additional piston and rod.		

APPROVED: YES _____ NO ____

Evaluator's Signature　　　　　　　　　　Date

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 122

TASK

Install rod bearings.

STANDARD OF PERFORMANCE OF TASK

The rod bearings must be properly seated, all bearings must be torqued and clearance checked as specified in service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Service manual
Micrometers
Plastigage
Soft-faced hammer

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Engines**, pp. 2-56 to 2-61.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . Engines**, pages 2-56 to 2-61.
2. Explain to students the various qualities a bearing must have.
3. Explain to students what bearing crush means.
4. Show students a diagram of connecting rod and bearings.
5. Demonstrate to students the proper method for installing rod bearings.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 122

CRITERION-REFERENCED MEASURE

Questions

1. ________ grooves are often placed on bearings to help distribute oil.
2. A good bearing must be able to resist _______ corrosion.
3. Lack of oil or oil _______ can cause severe damage to bearings.

Answers

1. Thumbnail
2. chemical
3. starvation

Practical Application

Have students install rod bearings to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 122 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 122

INSTALLING ROD BEARINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed all parts necessary to make piston and crankshaft accessible.		
3. Unbolted rod cap.		
4. Tapped cap loose from rod with a soft-faced hammer.		
5. Removed cap, noting its position for reassembly. (Marked it if not marked)		
6. Pushed rod away from crankshaft, taking care not to scratch crankshaft journal.		
7. Measured journal for excess wear.		
8. Pried insert from rod and rod cap.		
9. Removed rod bearings and installed new rod bearings.		
10. Installed new inserts in the same position.		
11. Oiled bearings lightly.		
12. Reseated rod on crankshaft journal.		
13. Reinstalled rod cap.		
14. Torqued to specifications.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 122

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
15. Removed cap and placed a strip of Plastigage across the full width of the insert.		
16. Replaced cap and torqued to specifications.		
17. Removed cap and measured Plastigage width using card that came with the Plastigage.		
18. If clearance was within specified limits, cleaned Plastigage from insert and journal. Lubricated , installed and torqued rod cap.		
19. Bent up lock tabs or installed lock wires as required.		
20. Reassembled engine.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 123

TASK

Install timing chain/gears.

STANDARD OF PERFORMANCE OF TASK

The alignment and tension torque of the timing chain/gears must be in accordance with the manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Timing gear or chain
Mechanic's tool set
Service manual
Pullers for the engine being worked on

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 285-86.
2. John Deere and Co. **Fundamentals of Service . . . Engines**, pp. 2-62 to 2-63.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 285 - 86.
2. Explain to students the importance of proper timing of gear train.
3. Show a drawing of the gear train to students.
4. Illustrate the proper method of finding timing marks.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 123

CRITERION-REFERENCED MEASURE

Questions

1. You must be certain that timing marks are properly ________.
2. Many gears in the engine gear train must be _______ to each other.
3. _______ is the amount of "play" between two gears in mesh.

Answers

1. aligned
2. timed
3. Backlash

Practical Application

Have students install a timing chain or gears to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 123 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 123

INSTALLING TIMING CHAIN OR GEARS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed timing chain (or timing gear) cover.		
3. Rotated engine and observed alignment of timing marks.		
4. Unbolted camshaft gear (sprocket).		
5. Pulled gear(s) (sprocket(s) with appropriate puller.		
6. Noted position for reassembly.		
7. Reassembled and installed timing parts, with timing marks correctly aligned.		
8. Reassembled other parts as necessary.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 124

TASK

Replace camshaft and camshaft bearings.

STANDARD OF PERFORMANCE OF TASK

All work must be accomplished without damage and the bearings must be aligned with no allowance for deviation from manufacturer's specifications and procedures.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine with defective camshaft
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use mechanic's tools.
3. Identify camshaft and bearings.

RESOURCE

Jacobsand Harrell. **Agricultural Power and Machinery**, pp. 283-84.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 283-84.
2. Discuss the importance of lubricating the crankshaft.
3. Demonstrate to students the proper way to line up timing marks.
4. Show students how to check backlash.
5. Demonstrate the proper method for checking end play.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 124

CRITERION-REFERENCED MEASURE

Questions

1. All the ______ followers should move freely.
2. Lubricate the camshaft ______ and lobes.
3. A ______ ______ or dial indicator should be used to check the backlash.

Answers

1. cam
2. journals
3. thickness gauge

Practical Application

Have students replace the crankshaft and crankshaft bearings to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 124 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 124

REPLACING CAMSHAFT AND CAMSHAFT BEARINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed front timing cover and fuel pump.		
3. Removed timing chain and gears.		
4. Removed pushrods and rocker arm assemblies.		
5. Removed valve lifters.		
6. Removed camshaft.		
7. Removed cam bearings and observed position of oil feed holes.		
8. Removed expansion plugs.		
9. Cleaned oil passages.		
10. Installed cam bearings in respective positions being careful to line up oil holes.		
11. Installed cam, making sure cam turns freely.		
12. Installed timing chain, sprockets, seals, gaskets, and timing cover.		
13. Installed lifters, pushrods, and rocker assembly.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 125

TASK

Replace dry sleeves.

STANDARD OF PERFORMANCE OF TASK

The sleeves must be removed without damage to the block; the block must be thoroughly cleaned and the new sleeves must be fully seated. Dry sleeves must meet manufacturer's specifications for counterbore, depth, roundness, press fit and cleanliness. All other components must meet conditions and tolerances specified by manufacturer.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Sleeve puller

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.
3. Identify dry sleeves.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 278.
2. John Deere and Co. **Fundamentals of Service . . . Engines**, pp. 2-25 to 2-26.

TEACHING ACTIVITIES

1. Discuss the types of cylinders.
2. Show a diagram of dry sleeves.
3. Demonstrate the proper method of cleaning the bore in the block.
4. Discuss the process of cleaning the new sleeves.
5. Demonstrate the proper procedure of replacing dry sleeves.
6. Have students demonstrate replacing dry sleeves properly.

PERFORMANCE OBJECTIVE 125

CRITERION-REFERENCED MEASURE

Questions

1. A ______ can be used to clean the bore.
2. Carbon left at the top of the bore can cause the new liner to ______.
3. ______ is the distance the sleeves extend past the top of the block.

Answers

1. deglazer
2. distort
3. "Standout"

Practical Application

Have students replace dry sleeves to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 125 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 125

REPLACING DRY SLEEVES

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed grease or cosmoline from new sleeve. Measured to insure proper size.		
3. Put new sleeves in freezer or packed in ice.		
4. Removed cylinder head and pistons. Put sleeve puller in place over one cylinder.		
5. Made sure puller disc bears only on the sleeve and did not contact cylinder block.		
6. Turned puller with hand tools and removed old sleeve.		
7. Removed other sleeves in the same way.		
8. Cleaned out cylinder holes in block.		
9. Removed new sleeves from freezer and inserted them quickly into their places.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 126

TASK

Replace piston rings.

STANDARD OF PERFORMANCE OF TASK

The piston must be clean and unscratched. Ring to groove clearance must be within manufacturer's specifications. Engine must operate to manufacturer's specifications without leaks and knocks.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Service manual
Drain pan
Piston rings
Mechanic's tool set
Ring expander
Ridge reamer
Ring compressor
Groove cleaner

ENABLING OBJECTIVES

1. Identify parts.
2. Read and interpret service manual.
3. Select and use mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 284.

TEACHING ACTIVITIES

1. Discuss the importance of installing the piston rings properly.
2. Illustrate the location of each piston ring.
3. Show students how piston rings are marked.
4. Demonstrate to students the proper method of using a ring-expanding tool.
5. Have students demonstrate the proper installation of piston rings.

PERFORMANCE OBJECTIVE 126

CRITERION-REFERENCED MEASURE

Questions

1. Use a ______ - ______ tool to install piston rings.
2. ______ the rings during installation can permanently distort the rings.
3. The ______ side of piston rings are usually marked.

Answers

1. ring-expanding
2. Overexpanding
3. top

Practical Application

Have students replace piston rings to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 126 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 126

REPLACING PISTON RINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Removed the cylinder head.		
2. Removed the oil pan.		
3. Reamed the ridge.		
4. Removed piston.		
5. Removed old rings.		
6. Cleaned piston and piston ring grooves.		
7. Using a ring expander, installed new rings, being careful not to scratch the piston. Placed rings on piston as shown on the instructions that came with the rings.		
8. Installed piston.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 127

TASK

Replace rocker arms/shaft.

STANDARD OF PERFORMANCE OF TASK

Valves must be adjusted to manufacturer's specifications. Rocker arms must be installed according to service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Rocker arms/shaft
Mechanic's tool set
Service manual
Outside micrometers
Telescoping gauges

ENABLING OBJECTIVES

1. Select and use mechanic's tools.
2. Read and interpret service manual.
3. Recognize rocker arm assembly.

RESOURCE

Jacob and Harrell. **Agricultural Power and Machinery**, p. 286.

TEACHING ACTIVITIES

1. Demonstrate the procedure of replacing rotators.
2. Discuss the procedure of positioning the rocker arm assembly.
3. Show students how to install retainer bolts.
4. Illustrate the proper way to torque rocker arm bolts.
5. Have students replace rocker arm assembly to manufacturer's specifications.

PERFORMANCE OBJECTIVE 127

CRITERION-REFERENCED MEASURE

Questions

1. You should remember to reconnect all ______ lines.

2. Some rocker arms are held in place by ______ bolts.

3. Tighten retainer bolts a ______ at a time.

Answers

1. oil
2. head
3. little

Practical Application

Have students replace the rocker arms according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 127 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 127

REPLACING ROCKER ARMS/SHAFT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Removed valve cover.		
2. Removed rocker arm assembly.		
3. Disassembled rocker arm assembly, keeping all parts in order.		
4. Inspected parts for wear. Used micrometer to measure clearances.		
5. Reassembled rocker arm assembly using new parts as necessary.		
6. Replaced assembly and adjusted valves.		
7. Replaced valve cover.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 128

TASK

Replace wet sleeves.

STANDARD OF PERFORMANCE OF TASK

Disassembly and reassembly must follow manufacturer's instructions. The out-of-roundness must be within manufacturer's specifications, the cylinder must not leak, and there must be no damage to any parts.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Wet sleeves
Service manual
Lubricants
Seals
Mechanic's tool set
Checking equipment

ENABLING OBJECTIVES

1. Select and use basic mechanic's tools.
2. Identify parts.
3. Read and interpret service manual.

RESOURCE

Jacob and Harrell. **Agricultural Power and Machinery**, p.286.

TEACHING ACTIVITIES

1. Draw a diagram of wet sleeves.
2. Explain why liners must be washed in solvent.
3. Discuss the proper method of cleaning the bore.
4. Show a diagram of liner standout of wet sleeves.
5. Have students demonstrate the proper replacement of wet sleeves.

PERFORMANCE OBJECTIVE 128

CRITERION-REFERENCED MEASURE

Questions

1. Use a ______ ______ to determine liner standout.
2. Three commonly used lubricants for sleeve o-rings are liquid soap, petroleum jelly, and ______ ______.
3. Wet sleeves can be removed with a block of wood and a ______.

Answers

1. straight edge
2. vegetable oil
3. hammer

Practical Application

Have students replace wet sleeves in a cylinder according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 128 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 128

REPLACING WET SELEVES

Student's Name Date

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Read manufacturer's service manual for instructions for removing all parts necessary to reach the cylinder sleeve.		
2. Removed sleeve with screw-threader or impact puller.		
3. Cleaned the lower sealing ring surface in the block to prevent coolant leakage past the sealing rings.		
4. Cleaned all deposits from under the flange of sleeve and mating bore in block.		
5. Checked sleeve bore in block, if flange surface was uneven, re-machining it.		
6. Cleaned lower sealing surfaces in block and sleeve to prevent coolant leaks when sleeve was installed		
7. Installed new sleeve without seals. Checked height at several places to be certain sleeve was seated squarely. Compared the height to engine specifications and machined the block or added shims if necessary.		
8. Removed sleeve and put new seals on sleeve. Lubricated the seal and the mating surface in the block with material recommended by manufacturer.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 128

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Worked sleeve into place by hand as far as possible. Finished seating the sleeve by placing a wood block over it and hammering gently.		
10. Checked for correct liner installation by measuring the out-of-roundness in the liner bore. If distorted, checked for twisted seals or deposits on the liner bore seats.		
11. Reassembled all parts, following instructions in the service manual.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING INTERNAL COMBUSTION ENGINES

PERFORMANCE OBJECTIVE 129

TASK

Replace piston.

STANDARD OF PERFORMANCE OF TASK

Upon completion, all clearance tolerances must be within manufacturer's specifications. Cooling system must have no leaks and engine must turn over freely by hand.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine
Manufacturer's specified oil
Lubricant
Coolant
Ridge reamer
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Identify parts.
2. Select and use basic mechanic's tools
3. Read and interpret service manual.

RESOURCE

Jacob and Harrell. **Agricultural Power and Machinery**, pp. 284-85.

TEACHING ACTIVITIES

1. Have students read and discuss the textbook, **Agricultural Power and Machinery**, pages 284-85.
2. Explain why pistons, rings, and pins should be thoroughly lubricated.
3. Discuss the procedure in using a ring compressor.
4. Show a diagram of the entire piston assembly.
5. Have students demonstrate the proper replacement of a piston.

PERFORMANCE OBJECTIVE 129

CRITERION-REFERENCED MEASURE

Questions

1. Pistons, rings, and pins should be lubricated with SAE ______ engine oil.
2. The ring end gaps should be ______ around the piston.
3. If rod caps are not tightened correctly, they will become ______ ______ ______.

Answers

1. 30W
2. staggered
3. out-of-round

Practical Application

Have students replace pistons according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 129 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 129

REPLACING PISTONS

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed cylinder head(s) and oil pan.		
2. Ridge reamed cylinders.		
3. Removed rod nuts and caps.		
4. Removed pistons and rod assemblies, marking each rod and cap as to location.		
5. Cleaned and inspected cylinder walls; checked for wear and taper.		
6. Deglazed cylinder walls.		
7. Checked crankshaft journals for wear and out-of-roundness.		
8. Replaced pistons, checking wrists pins for looseness; aligned pistons and rods.		
9. Checked piston rings in cylinder for correct ring gap.		
10. Installed rings on pistons; checking for correct placement on grooves.		
11. Lubricated rings generously and, using ring compressor, installed pistons into cylinders.		
12. Checked to be sure connecting rods are returned to proper crank journals and pistons are facing in correct direction.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 129

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Reinstalled connecting rod caps as per manufacturer's specifications.		
14. Reassembled engine components.		
15. Filled crankcase with proper amount and type of oil.		
16. Filled cooling system with coolant.		
17. Started engine, checking for oil leaks, oil pressure, and correct operating temperature as per manufacturer's specifications.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

SERVICING TIRES

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 130

TASK

Demount large implement tire.

STANDARD OF PERFORMANCE OF TASK

Tire must be demounted without damage to rim, tire or tube.

SOURCE OF STANDARD

Fundamentals of Service -- Tires and Tracks, Third Edition, p. 33.

CONDITIONS FOR PERFORMANCE OF TASK

Large implement tire
Hammer
"Bead-breaking" tool
Lubricant
Two long, clean, smooth tire irons
Service manual

ENABLING

1. Read and interpret service manual.
2. Select and use tire tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 29-30.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tire and Tracks,** Third Edition, pages 29-30.
2. Explain to students the proper safety procedures with demounting tires.
3. Show students a diagram of a tire being demounted.
4. Demonstrate to students the proper method of demounting a large implement tire.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 130

CRITERION-REFERENCED MEASURE

Questions

1. You should remove the valve core to completely ______ the tire.
2. You can loosen the upper bead from the rim by ______ around on the sidewall of the tire.
3. To break loose the top bead from the rim, you should place the tire irons about ______ apart.

Answers

1. deflate
2. walking
3. 10 inches

Practical Application

Have students demount a large implement tire according to recommended specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 130 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 130

DEMOUNTING LARGE IMPLEMENTT TIRES

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Supported vehicle and removed tire and wheel assembly.		
2. Removed liquid and air from the tire via the valve core.		
3. Broke bead with hammer and bead-breaking tool.		
4. After bead had been released completely around tire, turned tire and rim over and repeated for second bead.		
5. Lubricated rim flange, tire bead and base of tube.		
6. Pried bead over rim flange with two long tire irons until top bead was completely over rim flange.		
7. Braced weight of tire against solid support and pulled tube out of tire.		
8. With one side of bottom bead in rim well, inserted tire irons under opposite side of bead.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 130

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. With smaller tires, worked bottom bead over rim flange by taking small bites with two tire irons.		
10. With larger tires, stood tire on tread. With weight supported, and one person holding rim, worked second bead over rim flange until rim dropped out.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 131

TASK

Demount small implement tire with machine.

STANDARD OF PERFORMANCE OF TASK

Tire must be demounted without damage to tire or the rim.

SOURCE OF STANDARD

Fundamentals of Service -- Tires and Tracks, Third Edition, p. 32.

CONDITIONS FOR PERFORMANCE OF TASK

Small implement tire
Tire machine
Lubricant
Tire tools
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use tire tools and demounting machine.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 24-25.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pages 24-25.
2. Explain to students the proper safety procedures used with demounting tires.
3. Show students a diagram of a small implement tire being demounted.
4. Demonstrate to students the proper method of demounting a small implement tire with a demounting machine.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 131

CRITERION-REFERENCED MEASURE

Questions

1. After deflating a tire for demounting, one should then apply ________ at the top of the rim flange.
2. You should never use a ______ to loosen beads on a small tire.
3. You should loosen the tire beads from the rim with a ______ ______ tool.

Answers

1. lubricant
2. hammer
3. bead breaker

Practical Application

Have students demount a small implement tire with a machine according to recommended manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 131 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 131

DEMOUNTING A SMALL IMPLEMENT TIRE WITH A MACHINE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed valve core and completely deflated tire.		
2. Applied lubricant at top rim of flange.		
3. Loosened both tire beads from rim flanges with bead breaker tool.		
4. Pressed side of tire into rim well and removed first bead in regular manner.		
5. Removed the lower bead.		
6. Removed tire from the rim.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 132

TASK

Demount small implement tires without machine.

STANDARD OF PERFORMANCE OF TASK

Tire must be demounted without damage to tire or rim.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Small implement tire
Two, clean, smooth tire irons
Lubricant
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use tire tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 24-25.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Track,** Third Edition, pages 24-25.
2. Explain to students the proper safety precautions when demounting a tire.
3. Show a diagram of a tire being demounted.
4. Demonstrate to students the proper method of demounting a tire.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 132

CRITERION-REFERENCED MEASURE

Questions

1. You must first remove the ______ ______ to completely deflate the tire for demounting.
2. If you cannot break the bead from the rim with foot pressure, use any ______ ______ bead breaker.
3. When beginning the removal of tire from the rim, take small bites with the ______ ________.

Answers

1. valve core
2. commercial-type
3. tire irons.

Practical Application

Have students demount a small implement tire according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 132 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 132

DEMOUNTING SMALL IMPLEMENT TIRES WITHOUT A MACHINE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed valve core and completely deflated tire.		
2. Applied lubricant at top of rim flange.		
3. Started removal of outside bead at valve, taking small bites with irons around rim.		
4. Turned tire over and used two irons, one between rim flange and tire bead to pry rim upward and the other iron to pry outward between bead seat and tire bead.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 133

TASK

Demount tire with split rim.

STANDARD OF PERFORMANCE OF TASK

The rim and tire must not sustain damage during demount procedure.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Tire with a split rim
Tools and equipment for demounting
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use tire tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 36-37.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pages 36-37.
2. Explain the proper safety precautions when demounting a split rim.
3. Show a pictured illustration of a split rim being demounted.
4. Demonstrate to students the proper method of demounting a split rim.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 133

CRITERION-REFERENCED MEASURE

Questions

1. To insure proper safety when demounting an implement with split rims place a block under the ______ to prevent a jack from falling.
2. Make sure the valve will clear the ______ section before removing the tire from the rim.
3. Pry out the lock ring by starting at a ______ ______.

Answers

1. axle
2. gutter
3. prying notch

Practical Application

Have students demount a tire with a split rim according to recommended specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 133 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 133

DEMOUNTING TIRE WITH SPLIT RIM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Removed valve core and exhausted all air from tire.		
2. Applied lubricant at top rim of flange.		
3. Inserted special tool into breaking slots between seat and rim flange. Twisted tool in circular motion, moving tool around rim until band and flange were separated.		
4. Pried out lock ring.		
5. Removed bead seat band.		
6. Broke bead loose from rim on opposite side of wheel.		
7. Removed tire.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 134

TASK

Mount implement tire.

STANDARD OF PERFORMANCE OF TASK

Valve base must be firmly seated against inside of rim surface. There must be no damage to tire bead or valve.

SOURCE OF STANDARD

Fundamentals of Service -- Tires and Tracks, Third Edition, p. 27.

CONDITIONS FOR PERFORMANCE OF TASK

Implement tire
Rim
Clean, smooth tire irons
Lubricant
Mechanic's tool set
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use tire mounting tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 27-28.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pages 27-28.
2. Illustrate the proper safety techniques when mounting a tire.
3. Show a diagram of a tire being mounted properly.
4. Demonstrate to students the proper method of mounting an implement tire.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 134

CRITERION-REFERENCED MEASURE

Questions

1. To aid in mounting a tire, ______ ______ ______ can be used to make the tire tools slide more easily.
2. You must completely deflate the tube after the bead has seated to keep the tube from ______.
3. You can use a ______ ______ ______ to help mount and inflate a tubeless tire.

Answers

1. vaseline,vegetable oil, soap
2. buckling
3. tire bead expander

Practical Application

Have students mount an implement tire according to the recommended procedure of the textbook.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 134 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 134

MOUNTING AN IMPLEMENT TIRE

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Placed valve stem with rubber washer through valve hole from rim well side.		
2. Screwed on valve nut from opposite side, making sure the rubber bushing and metal collar on nut are centered and fit snugly in valve.		
3. Finished tightening with wrench.		
4. Placed rim on floor with side down and lubricated first bead of tire and upper bead seat of rim.		
5. Pushed first bead over flange and into rim well.		
6. Started second bead over rim flange into well by standing on tire.		
7. Pushed section of bead into rim well and anchored with vise-grips pliers by pinching onto rim flange.		
8. Used spoon end of iron with stop toward rim, worked progressively around bead using small bites until bead slipped over flange onto rim base.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 135

TASK

Repair tube puncture.

STANDARD OF PERFORMANCE OF TASK

Tube must not leak.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Tube with a puncture
Hot patch or cold patch repair kit

ENABLING OBJECTIVES

1. Recognize tube damage.
2. Select and use tube repair equipment.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 21-22.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Tubes,** Third Edition, pages 21-22.
2. Illustrate to students the various repair tools.
3. Discuss the cold patch tube repair method.
4. Discuss the hot patch tube repair method.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 135

CRITERION-REFERENCED MEASURE

Questions

1. Tubes can be repaired with cold patches but ______ patches are better.
2. You must be certain that any ______ is removed from the tire so as not to damage the tube.
3. Even with the best maintenance, ______ will be a source of problems.

Answers

1. hot
2. debris
3. cuts

Practical Application

Have students repair a tube puncture according to the textbook recommendations.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 135 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 135

REPAIR TUBE PUNCTURES

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
COLD PATCH: 1. Roughened area around puncture to same size as patch.		
2. Applied glue to the above area.		
3. Removed backing from patch.		
4. Applied patch to tube making sure there were no air pockets.		
5. Tested tube for leaks.		
HOT PATCH: 1. Followed above procedures.		
2. Clamped patch and tube in heating unit.		
3. Applied heat.		
4. Allowed to cool and removed from heating unit.		
5. Tested tube for leaks.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 136

TASK

Repair tubeless tire puncture.

STANDARD OF PERFORMANCE OF TASK

The repaired tire must be free from leaks.

SOURCE OF STANDARD

Fundamentals of Service -- Tires and Tracks, Third Edition, p. 26.

CONDITIONS FOR PERFORMANCE OF TASK

Tubeless tire with a puncture
Tire repair kit
Tools and equipment

ENABLING OBJECTIVES

1. Recognize tire damage.
2. Select and use tubeless tire repair tools.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 20-22.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pages 20-22.
2. Illustrate the various methods of repairing a tire.
3. Show a diagram of a tire being plugged.
4. Demonstrate the proper method used to repair a tubeless tire puncture.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 136

CRITERION-REFERENCED MEASURE

Questions

1. ______ tire repairs should not be made unless there is an emergency.
2. You may lubricate a tire puncture with ______ ______.
3. You should cut off the tubeless tire plug about ______ inch above the tire surface.

Answers

1. Temporary
2. vulcanizing fluid
3. 1/16

Practical Application

Have students repair a tubeless tire puncture according to textbook recommendations.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 136 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 136

REPAIRING TUBELESS TIRE PUNCTURES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Removed tire from rim.		
2. Located puncture.		
3. Scraped damaged area and buffed.		
4. Lubricated puncture externally and internally with vulcanizing fluid by using insertion tool.		
5. Installed plug-in insertion tool and lubricated thoroughly with vulcanizing fluid.		
6. Inserted the plug into puncture, released and removed insertion tool.		
7. Cut protruding end of plug 1/16" above surface of tire.		
8. Applied patch.		
9. Mounted tire on rim.		
10. Inflated tire and checked for leaks.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING TIRES

PERFORMANCE OBJECTIVE 137

TASK

Service tires with fluid.

STANDARD OF PERFORMANCE OF TASK

Tire pressure must not exceed manufacturer's recommended pressure and the fluid must be added to the recommended level.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Fluid inflated tires
Service manual
Jack
Tire pressure gauge
Hose and adapter

ENABLING OBJECTIVES

1. Recognize proper fluid level.
2. Interpret wheel slip formula.
3. Read and interpret service manual.

RESOURCE

John Deere and Co. **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pp. 7-13.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Fundamentals of Service . . . Tires and Tracks,** Third Edition, pages 7-13.
2. Show a pictured illustration of a properly fluid filled tire.
3. Discuss ballast limitations with students.
4. Show diagrams of tractor weight guides.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 137

CRITERION-REFERENCED MEASURE

Questions

1. The percent slip formula is ______.
2. If you overfill the tire with fluid it will ______ easily.
3. ______ ______ is added along with water to prevent the tire from freezing in the winter.

Answers

1. $\frac{R^2-R^1}{R^2}$
2. bruise
3. Calcium Chloride

Practical Application

Have students service tires with fluid according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 137 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 137

SERVICING TIRES WITH FLUID

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Used proper safety precautions and jacked up vehicle until tire to be filled was off the ground.		
2. Removed valve core to allow all air to escape from tube.		
3. Attached the special adapter to hose and to portion of valve stem still in tube.		
4. Rotated tire until valve stem, with hose attached was at the twelve o'clock position.		
5. Started fluid flowing into tube.		
6. Stopped flow of fluid once or twice during the filling process and pressed the air release button on the adapter to allow air trapped in the tube to escape.		
7. Rotated tire during the above procedure until fluid came out air bleed to determine the level of fluid in the tire.		
8. Continued filling until fluid came out air bleed with valve stem at twelve o'clock position. Stopped water flow, removed adapter from valve stem, and reinstalled portion of valve core that was removed.		
9. Checked and regulated inflation pressure.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

SERVICING MECHANICAL COMPONENTS OF BALERS

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 138

TASK

Replace compression roll spring, round baler.

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications without excessive noise and/or vibrations.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Operator's manual
Mechanic's tool set
Replacement parts
Round baler

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use mechanic's tools.

RESOURCE

Vermeer Manufacturing Co. **Vermeer Operator's Manual**, pp. 20-21.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Vermeer Operator's Manual**, pages 20-21.
2. Show students a schematic of baler.
3. Explain the safety problems that may occur in working with compression springs.
4. Demonstrate to students the proper replacement of the compression roll spring.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 138

CRITERION-REFERENCED MEASURE

Questions

1. The upper nuts on the spring should be _____ tight.
2. The roller arm on a round baler is _____ loaded.
3. You must always tighten the _____ nut after final adjustment is made.

Answers

1. finger
2. spring
3. lock

Practical Application

Have students replace the compression roll spring to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 138 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 138

REPLACING COMPRESSION ROLL SPRING

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed all shields and sheet metal to gain access to compression roll spring.		
3. Backed compression spring adjusting bolt all the way off and removed spring.		
4. Installed replacement spring and adjusted it.		
5. Test ran machine and observed operation. Readjusted as necessary with machine stopped.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 139

TASK

Replace floor and floor channels, round balers.

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications. Chain tension must be adjusted as specified in the service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Operator's manual
Mechanic's tool set
Replacement parts
Round baler

ENABLING OBJECTIVES

1. Interpret drawings in operator's manual.
2. Select and use basic mechanic's tools.

RESOURCE

Vermeer Manufacturing Co. **Vermeer Operator's Manual**, pp. 15 and 32.

TEACHING ACTIVITIES

1. Show schematic of baler frame.
2. Explain the safety factors involved in replacing floor and floor channels.
3. Discuss the proper method of disconnecting chains.
4. Demonstrate the proper method of replacing floor and floor channels.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 139

CRITERION-REFERENCED MEASURE

Questions

1. Baler chain must be adjusted to the proper _____ for baler to work properly.

2. You must remove shields and _____ to be able to remove the floor.

3 In order to remove the chain from the baler you must remove the _____ link.

Answers

1. tension
2. guards
3. master

Practical Application

Have students replace floor and floor channels on a round baler.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 139 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 139

REPLACING FLOOR AND FLOOR CHANNELS ON A ROUND BALER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual and complied with all safety rules.		
2. Removed shields and guards to gain access to area.		
3. Removed master links from floor chains and removed floor chain from baler.		
4. Removed hold down bolts and removed floor channels and floor.		
5. Replaced with new floor and floor channel segments.		
6. Replaced chains in baler and adjusted to proper tension.		
7. Replaced shields and guards.		
8. Ran test on baler, adjusted floor chain as prescribed in service manual.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 140

TASK

Replace rollers, round baler.

STANDARD OF PERFORMANCE OF TASK

Springs and belts must be adjusted to manufacturer's specifications. Machine must operate without excessive noise or vibration.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Round baler
Operator's manual
Mechanic's tool set
Replacement parts

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use basic mechanic's tools.

RESOURCE

Vermeer Manufacturing Co. **Vermeer Operator's Manual**, pp. 21-23 and 34-35.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Vermeer Operator's Manual,** pages 21-23 and 34-35.
2. Show a schematic of the roller system.
3. Explain the importance of proper installation of bearings on rollers.
4. Demonstrate the proper replacement of rollers.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 140

CRITERION-REFERENCED MEASURE

Questions

1. An ______ bearing is used to stabilize the outer end of the shaft.
2. A ______ pin is used to hold the shaft onto the shaft support.
3. ______ rollers are used to support the belts in between the propelled rollers.

Answers

1. outboard
2. roll
3. Idler

Practical Application

Have students replace rollers on a round baler.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 140 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 140

REPLACING ROLLERS ON A ROUND BALER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual.		
2. Removed all shields and sheet metal to gain access to rollers.		
3. Loosened compression roll spring so that belts were loose.		
4. Removed belts, roll pin, and set screw or whatever fastener was used by the manufacturer. Removed roller.		
5. Replaced with new roller and fastener, if necessary.		
6. Readjusted compression roller spring.		
7. Ran test and observed operation of compression roll springs and machine.		
8. Readjusted springs, if necessary, with machine stopped.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 141

TASK

Adjust knife arm, twine baler.

STANDARD OF PERFORMANCE OF TASK

The baler must operate according to manufacturer's specifications without excessive noise or vibration. Knife arm must operate to cleanly cut the twine.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Mechanics**, pages 387-88.
2. Show students a diagram of the knife arm.
3. Illustrate the proper safety techniques in adjusting the knife arm.
4. Demonstrate the proper adjustment of the knife arm.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 141

CRITERION-REFERENCED MEASURE

Questions

1. The ______ on the knife arm advances to remove the looped twine from the billhook.
2. The needle brings twine through the guide on the ______ ______.
3. The knife arm is used to ______ the twine.

Answers

1. wiper
2. knife arm
3. cut

Practical Application

Have students adjust the knife arm on a twine baler.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 141 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 141

ADJUSTING THE KNIFE ARM ON A TWINE BALER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. Adjusted knife arm as specified in manual.		
3. Operated machine and observed for correct operation.		
4. Readjusted, if necessary.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 142

TASK

Adjust knives on a twine baler.

STANDARD OF PERFORMANCE OF TASK

The knives must be adjusted to the manufacturer's specified clearances. The plunger must be in alignment with the connecting rod and crankshaft, and the plunger knife and stationary knife must be parallel.

SOURCE OF STANDARD

Owner's Manual -- 350 Hay Baler, p. 15.

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set
Shims

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 387.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 387.
2. Illustrate the function of knives on the twine baler.
3. Show a diagram of the bale chamber.
4. Demonstrate the proper adjustment of the knives.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 142

CRITERION-REFERENCED MEASURE

Questions

1. The knives must be adjusted to ______ specifications.
2. The ______ must be in alignment with the connecting rod and crankshaft.
3. The plunger knife and the stationary knife must be ______.

Answers

1. manufacturer's
2. plunger
3. parallel

Practical Application

Have students adjust knives on a twine baler.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 142 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 142

ADJUSTING KNIVES ON A TWINE BALER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual for safety procedures.		
2. Loosened the nuts on the six bolts attaching the roller guide to the bale chamber.		
3. Loosened the lock nut on each side of the hex head set screws then turned the three hex head set screws in, separating the roller guide from the bale chamber.		
4. Inserted shims between the roller guide and the bale chamber until the plunger ran true.		
5. Backed off the set screws far enough to remove the tension, tightened the lock nuts on the three hex head set screws, then tightened the nuts on the six roller guide mounting bolts.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 143

TASK

Adjust needles, twine baler.

STANDARD OF PERFORMANCE OF TASK

The needle height and clearances must be adjusted to the manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Mechanics**, pages 387-88.
2. Show a diagram of the bale chamber.
3. Illustrate the function of the needles.
4. Demonstrate the proper adjustment of the needles.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 143

CRITERION-REFERENCED MEASURE

Questions

1. You should refer to the ______ ______ for proper safety procedures.
2. The needle ______ and ______ must be adjusted to the manufacturer's specifications.
3. The ______ positions the twine in the twine discs.

Answers

1. service manual
2. height, clearance
3. needle

Practical Application

Have students adjust the needles on a twine baler to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 143 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 143

ADJUSTING NEEDLES ON A TWINE BALER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. Tripped the knotter mechanism by rotating the metering wheel in the direction of bale travel, then turned the flywheel counterclockwise until the needles were in their uppermost position.		
3. Measured clearance between the needles and the twine discs.		
4. Loosened the rear bolts on the needle clamp and tightened the front bolts to bring the needles closer to the twine discs.		
5. Loosened the front bolts and tightened the rear bolts to increase the distance between the needles and the twine discs.		
6. Adjusted the clearance between the needles and the bill hook pinion by loosening the needle clamp bolts and sliding the needles to the right or left. Retightened the needle clamp bolts securely.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 143

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
7. Loosened the jam nut and removed the clevis pin from the needle adjusting the clevises on both the left and right needle yoke drive rods to adjust the height of the needle travel. Turned each clevis equally until the correct measurement was obtained.		
8. Replaced the pins through the clevises and the lower holes of the needle yoke arms. Secured with the cotter pins, then tightened the jam nuts.		
9. Ran the needles through their cycle by hand to be sure all clearances were correct.		
10. Readjusted as necessary.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 144

TASK

Adjust slip clutches (drive line and pickup drive), twine baler.

STANDARD OF PERFORMANCE OF TASK

The clutch must operate to manufacturer's specifications without slippage.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 386.

TEACHING ACTIVITIES

1. Have students read textbook, **Agricultural Power and Machinery**, page 386.
2. Illustrate the function of slip clutch.
3. Show a diagram of the slip clutch.
4. Demonstrate the proper adjustment to the slip clutch.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 144

CRITERION-REFERENCED MEASURE

Questions

1. Clutch hold down bolts must be tightened to a specified _____.
2. Once an adjustment has been made you must run the baler to check for _____.
3. The clutch must operate to _____ specifications.

Answers

1. length
2. slippage
3. manufacturer's

Practical Application

Have students adjust slip clutches to manufacturer's specification.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 144 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 144

ADJUSTING SLIP CLUTCHES ON TWINE BALERS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. Tightened all clutch hold down bolts to specified length.		
3. Operated machine under load and checked for slippage.		
4. Adjusted as necessary.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 145

TASK

Adjust tucker (twine) fingers, twine baler.

STANDARD OF PERFORMANCE OF TASK

The twine fingers must hold the twine against the bill hook so it will not slip off as the bill hook starts to rotate.

SOURCE OF STANDARD

Owner's manual -- 350 Hay Baler, p. 21.

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery,** pages 387-88.
2. Show a diagram of the tying mechanism.
3. Illustrate the safety problems involved in adjusting fingers.
4. Demonstrate the proper adjustment of the twine fingers.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 145

CRITERION-REFERENCED MEASURE

Questions

1. You should refer to the ______ ______ for safety procedures.
2. You should disengage the _____ before starting adjustments on twine fingers.
3. The second step in making twine finger adjustments is to trip the _____ mechanism.

Answers

1. service manual
2. P.T.O.
3. knotter

Practical Application

Have students adjust the twine fingers on a bale to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 145 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 145

ADJUSTING TWINE FINGERS ON A TWINE BALER

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. On engine driven balers, shut off the engine and removed the belt from engine sheave. On P.T.O driven balers, disengaged P.T.O. and shut off tractor engine.		
3. Tripped the knotter mechanism and turned the flywheel counterclockwise until the needles passed through the slots in the top of the bale chamber and the twine finger points were in the middle of the needle slots.		
4. Loosened the jam nuts and removed the cotter pins and clevis pins from the two clevises.		
5. Loosened the four hex nuts which hold the twine finger assemblies to the frame. Moved the assemblies backward or forward until proper clearance is obtained. Retightened the nuts.		
6. Turned the flywheel until the needles were in the full down position and the knotter clutch is disengaged.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 145

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
7. Turned the clevis until the twine finger points were flush with the left edge of the needle slots in the top of the bale chamber. Attached the clevises to the cam tracer arms with the clevis pins and cotter pins, and secured with the jam nuts.		
8. With twine threaded through the baler needles, tripped the knotter mechanism and turned the flywheel slowly until the needles were in their uppermost position. Observed the position of the twine against the bill hooks.		
9. Readjusted, if necessary.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 146

TASK

Adjust twine disc, twine baler.

STANDARD OF PERFORMANCE OF TASK

Twine disc must be tight enough to hold twine while knot is being tied but not so tight as to cause the twine to break. Twine must not slip out of twine disc.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 387-88.
2. Explain the safety problems involved in adjusting twine discs.
3. Show a schematic of the tying area.
4. Demonstrate the proper performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 146

CRITERION-REFERENCED MEASURE

Questions

1. You must first loosen the nut on the ______ gear before adjusting the twine disc.
2. You must rotate the worm gear to ______ or ______ the twine disc.
3. You must tighten the nut to ______ the worm gear in position.

Answers

1. worm
2. advance, retard
3. lock

Practical Application

Have students adjust the twine disc to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 146 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 146

ADJUSTING TWINE DISCS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual for safety procedures.		
2. Loosened the nut on worm gear.		
3. Loosened worm gear on its shaft.		
4. Rotated worm gear as necessary to advance or retard the twine disc.		
5. Tightened nut to lock worm gear in position.		
6. Operated machine and observed for correct operation.		
7. Adjusted as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 147

TASK

Adjust bale care tension, twine baler.

STANDARD OF PERFORMANCE OF TASK

Bales must be uniform in size and density. Density must be appropriate to crop being baled as specified in service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 387.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 387.
2. Explain safety problems involved in adjusting bale tension.
3. Show a diagram of the bale chamber.
4. Demonstrate the performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 147

CRITERION-REFERENCED MEASURE

Questions

1. You must tighten or loosen manually the ______ ______ to adjust bale tension.
2. You may regulate the ______ valve to adjust bales hydraulically.
3. After adjustments are made you must operate the baler to check for bale ______.

Answers

1. tension handles
2. pressure
3. density

Practical Application

Have students adjust bale care tension to the desired bale density.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 147 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 147

ADJUSTING BALE CARE TENSION

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. Tightened or loosened tension handles to adjust bale tension manually.		
3. Regulated pressure valve to desired level to adjust bale tension hydraulically.		
4. Operated machine and checked for bale density.		
5. Readjusted as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 148

TASK

Replace bill hook, twine baler.

STANDARD OF PERFORMANCE OF TASK

Bill hook tension must meet manufacturer's specifications. Knots must be securely and evenly tied and twine must not break from too much tension.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set
Replacement part

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages. 387-88.
2. Show a schematic of the tying area.
3. Illustrate the function of the bill hook.
4. Demonstrate the performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 148

CRITERION-REFERENCED MEASURE

Questions

1. In replacing the bill hook you must slide the _____ _____ off the bill hook shaft.
2. You must drive out the _____ pin on the bill hook shaft.
3. When installing the bill hook you simply _____ the procedure.

Answers

1. drive gear
2. rale
3. reverse

Practical Application

Have students replace a bill hook to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 148 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 148

REPLACING BILL HOOK

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. Loosened the hold down bolts and raised the complete knotter assembly.		
3. Drove out rale pin on the end of the bill hook shaft.		
4. Slid drive gear off the bill hook shaft.		
5. Slid the bill hook out of the knotter assembly.		
6. Reversed above procedure to install bill hook.		
7. Adjusted bill hook by removing the cotter pin and either tightening or loosening the castellation nut. When desired tension was obtained, replaced the cotter pin in the nut.		
8. Test ran machine and observed for operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 149

TASK

Replace hay dog springs.

STANDARD OF PERFORMANCE OF TASK

Hay dog must operate to hold the hay in compression. Tension on hay dog springs must be specified in service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement parts
Hay baler

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 387.
2. Discuss the safety factors involved in this task.
3. Show a diagram of the bale chamber.
4. Demonstrate the performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 149

CRITERION-REFERENCED MEASURE

Questions

1. You must remove all _____ to gain access to the hay dogs.
2. You should replace all _____ when replacement of hay dog springs is complete.
3. The hay dog must operate to hold the hay in _____.

Answers

1. shields
2. shields
3. compression

Practical Application

Have students replace hay dog springs to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 149 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 149

REPLACING HAY DOG SPRINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specifications and safety regulations.		
2. Removed all shields and sheet metal to gain access to hay dogs.		
3. Removed hold down bolts or pins and removed hay dog.		
4. Slid new hay dog spring over hay dog.		
5. After replacing hay dog, adjusted in accordance with service manual.		
6. Replaced all shields and guards.		
7. Test ran and observed operation of hay dogs. Readjusted as necessary with machine stopped.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 150

TASK

Replace pin in bill hook pinion, twine baler.

STANDARD OF PERFORMANCE OF TASK

Upon completion, the machine must operate to manufacturer's specifications without excessive noise and vibration. The baler must tie a knot sufficient to hold the bale.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set
Replacement pin

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 387-88.
2. Discuss safety as it relates to the task.
3. Explain the importance of the pin in the bill hook pinion.
4. Demonstrate the performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 150

CRITERION-REFERENCED MEASURE

Questions

1. You must remove all ______ to gain access to the knotter.
2. To check a new pin in the billhook pinion, you must ____ the machine.
3. The baler must tie a ______ that is sufficient to hold a bale.

Answers

1. shields
2. operate
3. knot

Practical Application

Have students replace the pin in a bill hook pinion to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 150 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 150

REPLACING PIN IN BILL HOOK PINION

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Referred to service manual for safety procedures.		
2. Removed shields and sheet metal needed to gain access to knotter.		
3. Loosened knotter hold down pin or bolt.		
4. Raised knotter assembly and drove out pin.		
5. Installed new pin by reverse procedure.		
6. Operated machine to check operation.		
7. Readjusted if necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 151

TASK

Replace twine finger rod, twine baler.

STANDARD OF PERFORMANCE OF TASK

Machine must operate in compliance with manufacturer's specifications by correctly tying and cutting the bale holding knot. Knot must be cleanly tied and cut.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement parts
Baler

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 387-88.
2. Explain the function of a twine finger rod.
3. Show a diagram of tying mechanism.
4. Demonstrate the performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 151

CRITERION-REFERENCED MEASURE

Questions

1. You remove the twine finger rod by ______ the rod.
2. When a new twine finger rod is placed on the baler it must be ______.
3. You must ______ ______ the baler to check for proper knotter operation.

Answers

1. unscrewing
2. adjusted
3. test run

Practical Application

Have students replace a twine finger rod to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 151 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 151

REPLACING TWINE FINGER RODS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed shields and sheet metal to gain access to knotter assembly.		
3. Removed hold down bolts and raised knotter assembly.		
4. Removed twine finger rod by unscrewing the rod.		
5. Replaced with new rod and adjusted.		
6. Replaced knotter assembly and all sheet metal.		
7. Test ran machine and observed proper knotter operation. Readjusted if necessary with machine stopped.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 152

TASK

Replace twine knife, twine baler.

STANDARD OF PERFORMANCE OF TASK

The baler must operate to manufacturer's specifications without excessive noise or vibration. The twine knife must cleanly cut the twine.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Service manual
Mechanic's tool set
Replacement knife

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 387-88.
2. Discuss safety procedures involved in performing the task.
3. Explain the importance of the twine knife.
4. Demonstrate the proper replacement of a twine knife.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 152

CRITERION-REFERENCED MEASURE

Questions

1. The twine knife must be installed so it will ______ cut the twine.
2. You must slide the ______ knife and shaft out of knotter assembly.
3. You must make all adjustments in compliance with the ______ ______.

Answers

1. cleanly
2. complete
3. service manual

Practical Application

Have students replace a twine knife in accordance with manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 152 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 152

REPLACING TWINE KNIFE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual for safety procedures.		
2. Removed shields and sheet metal needed to gain access to knotter assembly.		
3. Loosened hold down bolt or pin and raised knotter assembly.		
4. Drove out roll pin or knotter pin from twine knife shaft.		
5. Slid complete knife and shaft out of knotter assembly.		
6. Reversed operation to replace new knife.		
7. Made adjustments outlined in service manual.		
8. Checked operation and adjusted further, if necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 153

TASK

Sharpen twin knife cutting edge, twine baler.

STANDARD OF PERFORMANCE OF TASK

Knives must cleanly cut twine so that both ends are even. Knives must be sharp enough that twine is not pulled from the twine disc during cutting.

SOURCE OF STANDARD

Owner's Manual -- 350 Hay Baler, p. 20.

CONDITIONS FOR PERFORMANCE OF TASK

Twine baler
Mechanic's tool set
Service manual
File or grinding wheel

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 387-88.
2. Discuss safety factors involved in performing the task.
3. Illustrate the proper method of sharpening a twine knife.
4. Demonstrate the performance of the task.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 153

CRITERION-REFERENCED MEASURE

Questions

1. Most of the time the twine knife can be ______ on the baler.
2. If the twine knives are not sharp, the twine will be ______ from the disc while cutting is taking place.
3. Knives must cleanly cut twine so that both ends are ________.

Answers

1. sharpened
2. pulled
3. even

Practical Application

Have students sharpen a twine knife so that it will cut twine cleanly and evenly.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 153 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 153

SHARPENING TWINE KNIFE CUTTING EDGE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Referred to service manual for safety specifications.		
2. Removed shields and sheet metal to gain access to knotter assembly.		
3. Removed hold down bolt or pin and raised knotter assembly.		
4. If twine knife could not be sharpened on the machine, drove out roll pin or knotter pin. Slid knife and shaft out.		
5. Sharpened blade with file or grinding wheel.		
6. Reversed above procedure to replace knife.		
7. Adjusted according to manufacturer's specifications.		
8. Operated machine. Adjusted as necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 154

TASK

Time feeder.

STANDARD OF PERFORMANCE OF TASK

Baler must operate according to specifications. Feeder tines must not contact plunger and must feed hay uniformly into bale chamber.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Baler

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Identify basic tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery,** p. 387.
2. John Deere and Co. **John Deere 14T Operator's Manual,** p. 22.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery,** page 387 and **John Deere 14T Operator's Manual** , page 22.
2. Identify the two types of time feeders.
3. Have students identify the parts of the feeder mechanism.
4. Have students explain how hay enters the bale chamber.
5. Describe the procedure for timing the feeder.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 154

CRITERION-REFERENCED MEASURE

Questions

1. ______ and ______ move the hay into the bale chamber.
2. The ______ can be adjusted to produce uniform bales when baling conditions vary.
3. The ______ must be timed to prevent the plunger from striking them as hay moves into the bale chamber.

Answers

1. Feed auger and feeder tines
2. feeder tines
3. feeder teeth

Practical Application

Have students time the feeder mechanism according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 154 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 154

TIMING A FEEDER

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for specific instructions.		
2. Removed shields or guards as necessary to gain access to feeder drive.		
3. Rotated the flywheel until the main crank was in the vertical position.		
4. Removed chain from feeder drive.		
5. Moved tine bar into alignment with timing marks and reinstalled chain.		
6. Adjusted chain tension to specifications in service manual.		
7. Rotated flywheel by hand through one rotation and checked operation and timing.		
8. Reinstalled guards and shields.		
9. Test ran machine and observed feeder timing.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 155

TASK

Time plunger.

STANDARD OF PERFORMANCE OF TASK

Timing must be set in compliance with service manual and baler must operate to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Baler
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 387-88.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 387-88.
2. Identify the parts of the hay packing process including plunger, hay dogs, bale chamber, plunger knife, stationary knife.
3. Have students explain how hay is pressed into a bale.
4. Explain how the plunger is checked for proper timing.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 155

CRITERION-REFERENCED MEASURE

Questions

1. The plunger must clear the _______ in all positions when properly timed.
2. Timing of the plunger is controlled by the _____.
3. As the plunger travels back, _______ hold hay in the bale chamber.

Answers

1. feeder assembly
2. drive chain
3. hay dogs

Practical Application

Have students time the plunger according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 155 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 155

TIMING PLUNGER

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed shields and sheet metal to gain access to plunger.		
3. Followed procedure in service manual to do timing.		
4. After timing is done, rotated the machine by hand to check if timing is correct.		
5. Test ran and observed operation of baler as a unit.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF BALERS

PERFORMANCE OBJECTIVE 156

TASK

Replace belts (round baler).

STANDARD OF PERFORMANCE OF TASK

Machine must operate within manufacturer's specifications. Belt tension must be adjusted in accordance with service specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement parts
Round baler

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Vermeer Manufacturing Co. **Vermeer Hay Baler Manual**, pp. 23-24.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Vermeer Hay Baler Manual**, pages 23-24.
2. Explain how to inspect the condition of baler belts and describe the condition for replacement according to manufacturer's specifications.
3. Draw a schematic of belt routing system.
4. Demonstrate how to remove worn belts and replace them with new ones.
5. Demonstrate how to adjust new belts according to manufacturer's recommendation.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 156

CRITERION-REFERENCED MEASURE

Questions

1. The ______ should also be replaced with new belts.
2. The belt connecting pin should be ______ longer than the width of the belt.
3. The baler should not be operated at ______ speed when the belts are loose.

Answers

1. connecting pin
2. 1 inch
3. high

Practical Application

Have students identify and replace worn belts on a round baler.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 156 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 156

REPLACING BELTS (ROUND BALER)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed shields and sheet metal to gain access.		
3. Loosened the bolt and adjustment spring, removed the pins that hold the flat belts together.		
4. Repeated this procedure on each belt. Replaced with reverse procedure.		
5. After each belt is replaced, adjusted in accordance with service manual specifications.		
6. Test ran machine and observed for proper belt operation. Readjusted belts, if necessary, with machine stopped.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 157

TASK

Stabilize concave leveling mechanism.

STANDARD OF PERFORMANCE OF TASK

The adjustment must be equal on both sides and must agree with the specifications in the operator's manual.

SOURCE OF STANDARD

Operator's Manual -- 6600 and 7700 Combines, pp. 70-71.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Combine
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** p. 407 and p. 409.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery,** pages 407 and 409.
2. Have students identify the cylinder, concave leveling adjustment and other related parts of the combine threshing mechanism.
3. Have students explain how grain is thrashed in a combine.
4. Describe the procedure for leveling the concave.
5. Have students explain why the concave should be level.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 157

CRITERION-REFERENCED MEASURE

Questions

1. The clearance between the concave and the cylinder must be the same at ______ sides of the concave.
2. A ______ ______ should be used to check the clearance between the concave and cylinder.
3. Damage to the combine may result if concave and cylinder clearance is set ______ ______.

Answers

1. both
2. feeler gauge
3. too close

Practical Application

Have students stabilize concave leveling mechanisms on a combine.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 157 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 157

STABILIZING CONCAVE LEVELING MECHANISM

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted operator's manual.		
2. Located and loosened adjusting bolt.		
3. Removed feeder housing.		
4. Closed concave.		
5. Measured equal distances from each end of the cylinder, between the rasp bar and the second grate bar.		
6. Adjusted the bolt to make the two measurements equal.		
7. Tightened adjuster lock nut.		
8. Readjusted concave to proper setting.		
9. Installed covers and feeder housing.		
10. Checked for operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 158

TASK

Replace concave.

STANDARD OF PERFORMANCE OF TASK

Concave must be equally adjusted on both sides of the machine. Concave setting must be in accordance with specifications in operator's manual. There must be no damage to adjoining parts.

SOURCE OF STANDARD

Repair Manual. John Deere Combine.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Operator's manual
Replacement concave
Combine

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use basic mechanic's tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 406-407.
2. Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, pp. 28-29.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 406-407 and **Massey-Ferguson 300 Combine Operator's Manual** pages 28-29.
2. Have students identify the concave of a combine.
3. Explain how to inspect the condition of the concave.
4. Demonstrate how to remove damaged concave.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 158

CRITERION-REFERENCED MEASURE

Questions

1. If damage to the concave is extensive, the ______ ______ should also be replaced.

2. Damage to the ______ should also be inspected when checking the concave.

3. ______ rods of the concave can be straightened if damage is not severe.

Answers

1. whole assembly
2. cylinder
3. Bent

Practical Application

Have students replace the concave of a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 158 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 158

REPLACING CONCAVE

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted operator's manual.		
2. Removed any parts that might block access to the concave.		
3. Loosened the adjusting and retaining bolts.		
4. Removed damaged concave using caution not to damage adjoining parts.		
5. Inspected area for other damage.		
6. Installed new or conditioned concave.		
7. Secured all retaining bolts and adjuster.		
8. Leveled concave.		
9. Proportioned concave.		
10. Replaced parts removed to gain access to concave.		
11. Checked out operation of machine.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 159

TASK

Replace cutterbar.

STANDARD OF PERFORMANCE OF TASK

The bar must be installed and adjusted so it is level with the ground, and play must be within specifications.

SOURCE OF STANDARD

Fundamentals of Machine Operation -- Combine Harvesting. p. 172.

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Combine header
Replacement cutterbar
Operator's manual

ENABLING OBJECTIVES

1. Read and interpret a operator's manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey - Ferguson 300 Combine Operator's Manual**, p. 17.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, page 17.
2. Have students identify the parts of the cutterbar assembly.
3. Have students inspect the cutterbar for damaged or broken parts.
4. Demonstrate how to reassemble new or repaired cutterbar.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 159

CRITERION-REFERENCED MEASURE

Questions

1. Knife sections should be checked periodically and any that are ______ should be replaced.
2. The knife guards should be checked for ______.
3. When knife is installed, run it backward and forward a few times to make sure it is not ______.

Answers

1. broken
2. alignment
3. binding

Practical Application

Have students remove, repair or replace cutterbar and reassemble according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 159 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 159

REPLACING CUTTERBAR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted operator's manual.		
2. Disconnected the cutterbar drive.		
3. Pulled the knife out of the cutterbar.		
4. Slid in new or reconditioned cutterbar.		
5. Adjusted guards.		
6. Adjusted pitman arm.		
7. Checked machine for operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 160

TASK

Replace feeder conveyor.

STANDARD OF PERFORMANCE OF TASK

The conveyor must be installed and tension must be adjusted in accordance with operator's manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Combine or header with feeder housing
Operator's manual
New conveyor

ENABLING OBJECTIVES

1. Read and interpret operators manual.
2. Select and use basic mechanic's tools.

RESOURCES

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, pp. 19-23.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, pages 19-23.
2. Have students identify the feeder conveyor and related parts.
3. Have students explain the function of the feeder conveyor.
4. Demonstrate how to replace the feeder conveyor.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 160

CRITERION-REFERENCED MEASURE

Questions

1. The feeder conveyor moves the grain from the table and conveys it to the______.
2. Overtightening of the conveyor chains may cause the chains to ________ and also overloads the ________.
3. The conveyor chains should be tightened until they are ______ but not excessively tight.

Answers

1. cylinder
2. stretch, bearings
3. snug

Practical Application

Have students replace the feeder conveyor according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 160 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 160

REPLACING FEEDER CONVEYOR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted operator's manual.		
2. Removed covers and doors to feeder housing.		
3. Removed chain drives and belts.		
4. Disconnected feeder conveyor chain.		
5. Pulled out old chain.		
6. With wire or rope pulled new conveyor into housing over sprockets.		
7. Reconnected conveyor chain.		
8. Adjusted conveyor to proper tension.		
9. Connected drive chains and belts.		
10. Installed covers and doors to feeder housing.		
11. Checked for proper operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HAVESTERS

PERFORMANCE OBJECTIVE 161

TASK

Replace gathering chains.

STANDARD OF PERFORMANCE OF TASK

The chains must be installed and adjusted with correct tension and timing as specified in the operator's manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Corn header
New chains
Operator's manual

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use basic mechanic's tools.

RESOURCE

Phipps. **Mechanics in Agriculture,** pp. 478-79.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture,** pages 478-79.
2. Have students identify gathering chains on a corn header of a combine.
3. Have students examine the gathering chains and inspect for wear.
4. Have students explain how the gathering chains remove corn from the stalk.
5. Demonstrate how to repair and replace gathering chains.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 161

CRITERION-REFERENCED MEASURE

Questions

1. When gathering chains become worn so that they are loose and when the take up in the adjust tablesprocket has been used, the chains should be ________.
2. Smooth-snapping rolls may be roughened by ______ ______ on them.
3. Sprockets that are not in line should be ______.

Answers

1. replaced
2. welding beads
3. aligned

Practical Application

Have students replace gathering chains according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 161 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 161

REPLACING GATHERING CHAINS

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted operator's manual for procedures.		
2. Removed shields over chains.		
3. Loosened adjusting bolts and slid tension bar back.		
4. Removed old chain.		
5. Installed new chain in proper time with opposite chain.		
6. Adjusted tension, checked timing.		
7. Tightened adjusting bolts.		
8. Reinstalled covers.		
9. Checked for correct operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HAVESTERS

PERFORMANCE OBJECTIVE 162

TASK

Replace grain or corn header.

STANDARD OF PERFORMANCE OF TASK

All hoses, belts and chains must be adjusted and corn header must operate according to manufacturer's specifications with no damage to grain.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Replacement head
Combine
Operator's manual

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery,** p. 404.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery,** page 404.
2. Discuss how to select a site to store header after removal.
3. Explain how to safely block up and secure header not in use.
4. Describe the procedure for removing and replacing header.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 162

CRITERION-REFERENCED MEASURE

Questions

1. The unused header should be stored on a _______ and _______ surface when not connected to the combine.
2. The feeder housing should be moved _______ and _____ into header.
3. Chain sprockets and belt pulleys should be checked for _____ after new header is attached.

Answers

1. flat, stable
2. slowly, carefully
3. alignment

Practical Application

Have students replace grain or corn header on combine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 162 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 162

REPLACING GRAIN OR CORN HEAD

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted operator's manual.		
2. Selected place to set down old head.		
3. Shored up and supported head so it will be safe and secure when disconnected.		
4. Disconnected the hoses and drive chains.		
5. Disconnected the head from the feeder housing.		
6. Moved combine to new head.		
7. Aligned combine to head.		
8. Moved feeder housing into new head slowly and carefully.		
9. Secured feeder housing to new head.		
10. Connected chains, belts and hoses.		
11. Checked sprocket sides and adjustment.		
12. Checked head for shipping blocks, wires, and servicing.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 163

TASK

Replace rotor on combine (cylinders).

STANDARD OF PERFORMANCE OF TASK

The replacement must be completed in accordance with manufacturer's specifications. Rotor must be level and without side play.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Pullers
Service manual
Combine
Cylinder

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual,** pp. 30-32.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual,** pages 30-32.
2. Have students identify the rotor and related parts on a combine.
3. Have students explain the mechanical function of the rotor (cylinder).
4. Have students explain how the speed of the cylinder is changed.
5. Demonstrate how to remove the rotor (cylinder) on a combine.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 163

CRITERION-REFERENCED MEASURE

Questions

1. The cylinder is driven by a combination of ______ ______ and ______.
2. To remove the rotor from the combine, it is first necessary to remove the ______ and the ______.
3. The tension of the cylinder drive chain may be adjusted by repositioning ______.

Answers

1. pulleys, sprockets, and chains
2. feeder house and head
3. idler sprocket

Practical Application

Have students replace rotor on combine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 163 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 163

REPLACING ROTOR ON COMBINE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed head and feeder housing.		
3. Removed belts and pulleys on cylinder shaft.		
4. Removed door on front and side of cylinder.		
5. Moved concave away from the cylinder as far as possible.		
6, Loosened and removed the locking collars and bearings from the cylinder shaft.		
7. Loosened and removed the bolts inside cylinder center to shaft.		
8. Blocked up cylinder and moved shaft out either side.		
9. Removed cylinder out the front of the machine.		
10. Moved in new cylinder.		
11. Placed shaft in position.		
12. Reinstalled bolts, bearings and collars.		
13. Adjusted cylinder.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 163

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
14. Reinstalled pulleys, doors, and belts.		
15. Adjusted belts and concave.		
16. Replaced doors and covers.		
17. Rotated and checked clearance and leveling.		
18. Replaced feeder house and head.		

APPROVED: YES _____ NO ____

Evaluator's Signature ____________________ Date

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 164

TASK

Replace snapping plates (bars).

STANDARD OF PERFORMANCE OF TASK

The snapping plates must be installed and adjusted to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mechanic's tool set
Plates
Service manual
Corn header

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 404.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 404.
2. Have students identify the snapping plates and related parts of the corn header.
3. Have students explain how corn is snapped from the stalk and conveyed to the feeder house.
4. Demonstrate how to replace snapping plates.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 164

CRITERION-REFERENCED MEASURE

Questions

1. The corn head is actually a mechanical ________ ________.
2. The snapping rolls turn in ________ directions.
3. The stripping plates eliminate the shelling of the corn at the ________ ________.

Answers

1. corn picker
2. opposite
3. snapping rolls

Practical Application

Have students replace the snapping plates on a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 164 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 164

REPLACING SNAPPING PLATES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed the header covers.		
3. Loosened the bolts holding the bars.		
4. Loosened the chains, if needed.		
5. Removed the bolts and bars.		
6. Replaced with new bars.		
7. Installed and adjusted bolts.		
8. Adjusted bars to width equal the cornstalk.		
9. Tightened all bolts.		
10. Installed covers on head.		
11. Checked for operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HAVESTERS

PERFORMANCE OBJECTIVE 165

TASK

Replace straw walkers.

STANDARD OF PERFORMANCE OF TASK

Replace straw walkers and adjust to manufacturer's specifications. When installed, no binding of straw walker must be present during operation.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine needing straw walkers replaced
Replacement straw walkers
Mechanic's tool set
Bearing shims (if needed)
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, p. 406.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page 406.
2. Have students identify the straw walker and related parts.
3. Have students explain the function of the straw walker.
4. Have students explain how the grain and straw are separated.
5. Demonstrate how to replace the straw walker.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 165

CRITERION-REFERENCED MEASURE

Questions

1. The straw walker _______ the straw as it moves it out the back of the combine.
2. Grain falling through the straw walker is carried to the _______.
3. _______ are used to keep the straw in contact with the straw walker.

Answers

1. shakes
2. cleaning shoe
3. Curtains

Practical Application

Have students replace straw walkers on a combine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 165 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 165

REPLACING STRAW WALKERS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2, Removed return pan to gain access to walker bearings.		
3. Unbolted rear walker bearing, marking bearing halves for identification and then removed bearing.		
4. Removed shaker shoe sieves.		
5. Unbolted and removed front bearing halves, marking for identification.		
6. Removed straw walkers.		
7. Installed new straw walkers.		
8, Replaced and adjusted bearings in locations removed one at a time.		
9. Replaced shaker shoe sieves.		
10. Installed return pan.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 166

TASK

Replace threshing cylinder.

STANDARD OF PERFORMANCE OF TASK

Threshing cylinder must be replaced and adjusted according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine needing threshing cylinder replacement
Service manual
Large pry bar
Mechanic's tool set
Large puller set
New cylinder

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agriculture Power and Machinery**, p. 405.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, page. 405.
2. Have students identify the threshing cylinder and related parts.
3. Have students explain how the threshing cylinder separates seed from the seed head.
4. Have students explain how the speed of the threshing cylinder is increased or decreased for varying crops harvested.
5. Demonstrate how to replace the threshing cylinder.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 166

CRITERION-REFERENCED MEASURE

Questions

1. The ________ ________ cylinders is the most common type of threshing cylinder on a combine.
2. Cylinder speed is adjustable and may range from ______ to ______ RPM.
3. The cylinder consists of ________ mounted on two hubs that are supported on a shaft that runs the length of the threshing unit.

Answers

1. rasp bar
2. 200-1500
3. bars

Practical Application

Have students replace the threshing cylinder of a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 166 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 166

REPLACING THRESHING CYLINDER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2, Removed parts necessary to gain access to the threshing cylinder.		
3. Lowered concave assembly.		
4. Removed cylinder speed assembly indicator.		
5. Removed cylinder drive belts and pulleys.		
6. Removed cylinder shaft flanges and bearings.		
7. Removed cylinder assembly.		
8. Removed rasp bars and filler plates from old cylinder.		
9. Installed rasp bars and filler plates on new cylinder.		
10. Installed new cylinder.		
11. Installed and adjusted cylinder shaft bearing.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 166

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
12. Installed cylinder drive pulley (Aligned, it if necessary).		
13. Installed speed indicator.		
14. Adjusted concave according to crops to be harvested.		
15. Replaced parts removed to gain access to cylinder.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 167

TASK

Replace threshing fans.

STANDARD OF PERFORMANCE OF TASK

When installed, fan must create enough air movement to remove all foreign materials lighter than the grain being harvested.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine needing threshing fan or replacement
New fan
Service manual
Mechanic's tool set
Big puller set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agriculture Power and Machinery**, p. 405

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agriculture Power and Machinery**, page 405.
2. Have students explain how air is used to help separate the seed from the husk.
3. Have students identify the threshing fans on a combine.
4. Explain how to remove and replace threshing fans.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 167

CRITERION-REFERENCED MEASURE

Questions

1. Air from the threshing fans blows up through the ________.
2. A large ________ ________ is needed to remove the threshing fans.
3. The larger the grain being harvested, the ________ the volume of air required.

Answers

1. chaffer
2. gear puller
3. stronger

Practical Application

Have students replace the threshing fans on a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 167 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 167

REPLACING THRESHING FANS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed all shields necessary to attain access to fan.		
3. Removed drive belt.		
4. Removed bearings on fan drive shaft.		
5. Removed fan.		
6. Installed new fan.		
7. Replaced bearings and adjusted so that fan turned freely and did not strike fan housing.		
8. Replaced drive belt and tensions in accordance with manufacturer's specifications.		
9. Replaced all shields that were removed to gain access to fan.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 168

TASK

Adjust cylinder to concave, corn harvester.

STANDARD OF PERFORMANCE OF TASK

When adjusted, concave and cylinder must thresh corn without cracking or damaging grain.

SOURCE OF STANDARD

Fundamentals of Machine Operation--Combine Harvesting, p. 35.

CONDITIONS FOR PERFORMANCE OF TASK

Combine
Service manual
Tape measure
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCES

Jacobs and Harrell. **Agriculture Power and Machinery**, pp. 409-11.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agricultural Power and Machinery**, pages 409-11.
2. Have students show how to adjust cylinder speed on a combine.
3. Have students show how to adjust the concave on a combine.
4. Have students identify correct cylinder speed and concave setting according to operator's manual for harvesting corn.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 168

CRITERION-REFERENCED MEASURE

Questions

1. Basic cylinder and concave adjustments for different crops are listed in the ________ ________.
2. The cylinder should be run just fast enough and close enough the concave to remove the maximum amount of seeds from the head without breaking up the ________.
3. The number of concave bars should be changed as specified when ________ ________.

Answers

1. operator's manual
2. straw
3. different crops are harvested

Practical Application

Have students adjust cylinder to concave on a combine to harvest corn according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 168 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 168

ADJUSTING CYLINDER TO CONCAVE, CORN HARVESTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed parts to obtain access to cylinder concave.		
3. Placed concave adjustment lever in widest position.		
4. Adjusted front of concave to bottom of travel.		
5. Adjusted rear of concave so that clearance between last concave bar and rasp bars was according to manufacturer's specifications.		
6. Replaced removed parts.		
7. Adjusted concave adjustment lever so that corn was threshing from cob without cracking of grain.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 169

TASK

Adjust cylinder cut-off bar.

STANDARD OF PERFORMANCE OF TASK

Cylinder must be adjusted to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine in need of cylinder cut-off bar adjustment
Mechanic's tool set
Operator's manual
Means of measuring clearance in cylinder

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use basic mechanic's tools.

RESOURCES

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 409-11.
2. Massey Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, p. 25 and p. 33.

TEACHING ACTIVITIES

1. Have students read and discuss textbooks, **Agricultural Power and Machinery**, pages 409-11 and **Massey-Ferguson 300 Combine Operator's Manual**, pages 25 and 33.
2,. Have students explain why it is necessary to adjust cylinder cut-off bar.
3. Have students identify the cylinder cut-off bar and related parts.
4. Demonstrate how to adjust cylinder cut-off bar.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 169

CRITERION-REFERENCED MEASURE

Questions

1. Specific clearances needed to make adjustments on cylinder cut-off bar may be found in the ________ ________.
2. ______ ______ can be used as a feeler gauge to measure cylinder cut-off bar clearance.
3. To check the correct setting, it is recommended that the _____ be removed.

Answers

1. Operator's Manual
2. Metal pieces
3. table

Practical Application

Have students adjust cylinder cut-off bar on a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 169 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 169

ADJUSTING CYLINDER CUT-OFF BAR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed necessary parts in order to gain access to adjusting mechanisms.		
3. Removed inspections cover.		
4. Made adjustments to specified clearances.		
5. Replaced parts removed.		
6. Checked operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 170

TASK

Adjust drag chains and links.

STANDARD OF PERFORMANCE OF TASK

When adjusted, drag links must deliver crops from header to concave with no contact with floor of feeder housing and with no damage to chain.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, p. 21.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, page 21.
2. Have students identify the drag chains and related combine parts.
3. Have students explain the function of the drag chains.
4. Have students discuss the hazards of an improperly adjusted drag chain.
5. Illustrate the proper procedure for adjusting the drag chains.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 170

CRITERION-REFERENCED MEASURE

Questions

1. The table elevator receives the grain from the table and conveys it directly into the ______ and ______.
2. Overtightening of drag chains causes overload on the _____and stretches the ________ ________.
3. Drag chains should be adjusted ________at both sides.

Answers

1. cylinder, concave
2. bearings, chain assembly
3. equally

Practical Application

Have students adjust the drag chains on combine table elevator according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 170 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 170

ADJUSTING DRAG CHAINS AND LINKS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Read service manual section concerning drag chains and links.		
2. Removed inspection door so that lower portion of chain could be seen.		
3. Adjusted chain evenly on both sides so it did not touch floor or feeder housing.		
4. Replaced inspection door.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 171

TASK

Adjust elevator chains.

STANDARD OF PERFORMANCE OF TASK

Elevator paddles must deliver grain to grain tank without damage to crop or chain due to improper chain tension.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine
Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, p. 44.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, page 44.
2. Have students identify the elevator chain.
3. Have students discuss the hazards of an improperly adjusted elevator chain.
4. Illustrate the proper procedure for adjusting the elevator chains.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 171

CRITERION-REFERENCED MEASURE

Questions

1. The elevator chains carry clean grain from the lower sieve to the ______ ______.
2. It is advisable to remove the elevator access door when the combine is shut off so ______ will not accumulate.
3. The elevator chain should be adjusted to allow ______ to ______ inch free play.

Answers

1. grain tank
2. water
3. 1/16 to 1/8

Practical Application

Have students adjust combine elevator chains according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 171 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 171

ADJUSTING ELEVATOR CHAINS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed elevator drive chain.		
3. Removed inspection cover.		
4. Adjusted elevator chain so paddles did not tip.		
5. Replaced inspection cover.		
6. Replaced drive chains.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 172

TASK

Adjust floating shoes.

STANDARD OF PERFORMANCE OF TASK

Shoes must maintain height of cutterbar so that crops are cut at a uniform height while providing a base which must prevent cutterbar from hitting the dirt or other obstacles.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine in need of floating shoe adjustment
Mechanic's tool set
Tape measure
Service manual

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

1. Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 403-04

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agriculture Power and Machinery**, pages 403-04.
2. Have students explain the function of floating skid shoes.
3. Have students discuss the kind of harvested crops and types of field conditions that require the use of floating shoes on the combine header unit.
4. Describe the procedure for adjusting floating shoes.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 172

CRITERION-REFERENCED MEASURE

Questions

1. The platform cutting height is automatically controlled by floating shoes located ________ ________ ________.
2. The floating shoes act as ______ which raise or lower the header as the ground contour varies.
3. Automatic header height controls are used extensively when harvesting soybeans and small grains that have ________.

Answers

1. under the platform
2. sensors
3. lodged

Practical Application

Have students adjust floating shoes on the combine healer according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 172 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 172

ADJUSTING FLOATING SHOES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Loosened adjustment on floating shoes.		
3. Lowered header so that desired height was attained according to manufacturer's specifications.		
4. Tightened shoes.		
5. Checked operation.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 173

TASK

Adjust reel speed.

STANDARD OF PERFORMANCE OF TASK

Adjust reel to manufacturer's specifications. Reel must deliver even flow of crops to table auger without loss due to excess reel speed.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine
Operator's manual
In-field conditions

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2 Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, pp. 15-16.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, pages 15-16.
2. Have students explain why reel speed should be variable.
3. Have students discuss the function of the reel on a combine.
4. Explain how to adjust reel speed to ground speed.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 173

CRITERION-REFERENCED MEASURE

Questions

1, When harvesting grain with long straw, set the reel ______ and ______ to lean the straw into the knife.

2. The speed of the reel is related to ________ speed.

3 As a general rule, the speed of the reel should be slightly ________ than the ground speed of the combine.

Answers

1. low, forward
2. ground
3. faster

Practical Application

Have students adjust the reel speed of a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 173 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 173

ADJUSTING REEL SPEED

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted operator's manual.		
2. Adjusted reel speed as directed in operator's manual.		
NOTE: When adjusting reels with variable speed pulleys, adjust only with reel turning.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 174

TASK

Adjust sieves.

STANDARD OF PERFORMANCE OF TASK

When adjusted, sieves must remove all particles larger than the grain being gathered and heavier than chaff.

SOURCE OF STANDARD

State of Florida Writing Team.

CONDITIONS FOR PERFORMANCE OF TASK

Combine
Service manual
In-field conditions
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, pp. 38-39.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, pages 38-39.
2. Have students discuss how the final separation of the grain from the chaff is achieved.
3. Have students identify upper and lower sieve on a combine.
4. Have students list the sieve adjustment setting for four different crops
5. Have students distinguish the functions of the upper and of the lower sieve.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 174

CRITERION-REFERENCED MEASURE

Questions

1. The opening of the sieve is measured in ________.
2. Opening the upper sieve too wide allows an excess of ______ to pass through and hinder the cleaning process.
3. The lower sieve is the final cleaning sieve, and should be adjusted to the ________ opening possible.

Answers

1. inches
2. chaff
3. smallest

Practical Application

Have students adjust sieves on a combine according to the manufacturer's specifications for the crop harvested.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 174 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 174

ADJUSTING SIEVES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed all parts necessary to gain access to sieves.		
3. Raised upper sieves.		
4. Adjusted lower sieves as specified in service manual.		
5. Replaced upper sieves and adjusted.		
6. Repeated if necessary.		
7. Replaced removed parts.		
8. Checked operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 175

TASK

Adjust snapping rolls.

STANDARD OF PERFORMANCE OF TASK

All adjustments must be made to manufacturer's specifications and corn head must snap corn ears from stalk with little or no loss due to shattering at snapping unit.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Corn head needing snapping rolls adjusted
Operator's manual
Mechanic's tool set
Safety stands

ENABLING OBJECTIVES

1. Read and interpret operator's manual.
2. Select and use basic mechanic's tools.

RESOURCE

Sperry New Holland Corp. **New Holland 962 Corn Head Operator's Manual**, p. 25.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland 962 Corn Head Operator's Manual**, page 25.
2. Have students identify snapping rolls and related parts on a combine corn head.
3. Have students explain how corn is snapped from the corn stalk.
4. Have students discuss the procedure for timing the snapping rolls.
5. Demonstrate how to adjust knives to maintain proper clearance between knives and snapping rolls.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 175

CRITERION-REFERENCED MEASURE

Questions

1. The four blades on the snapping roll knives must be checked regularly and torqued to ________ ft. lbs.
2. The snapping roll knives must be adjusted to maintain a clearance of ________ between knives and snapping rolls.
3. There are ________ long and ________ short knives per row unit.

Answers

1. 80-85
2. 1/32" (.030)"
3. two, two

Practical Application

Have students adjust the snapping rolls on a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 175 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 175

ADJUSTING SNAPPING ROLLS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Raised corn head and installed safety stands.		
3. Removed parts necessary to gain access to snapping rolls		
4. Adjusted snapping rolls as described in service manual.		
5. Replaced parts removed.		
6. Removed stands.		
7. Tested corn head for proper adjustment.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 176

TASK

Adjust stripper plates.

STANDARD OF PERFORMANCE OF TASK

Plates must be centered directly over the row, must be adjusted to the manufacturer's specifications, and must operate according to specifications. There must be minimal or no ear loss due to maladjusted stripper plates.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Sperry New Holland Corp. **New Holland 962 Corn Head Operator's Manual**, p. 24.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland 962 Corn Head Operator's Manual**, page 24.
2. Have students identify the stripper plates and related parts of a corn head.
3. Have students explain the function of the stripper plates.
4. Show how to make a gauge from two pieces of wood to be used in checking stripper plate clearance.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 176

CRITERION-REFERENCED MEASURE

Questions

1. The stripper plates are designed to _______ the ears from the stalk.
2. Stripper plate should be set far enough apart to allow as much _______ as possible to pass through.
3. Stripper plates should be centered over the _______ _______.

Answers

1. strip
2. trash
3. snapping rolls

Practical Application

Have students adjust stripper plates on a combine corn head according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 176 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 176

ADJUSTING STRIPPER PLATES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted the service manual for safety procedures.		
2. Removed necessary hardware to gain access to the stripper plates.		
3. Used the special gauge provided by the manufacturer to check the position of the stripper plates.		
4. Adjusted swing stripper plate adjusting lock up and turned cap screws in or out.		
5. Relocked the cap screw in place.		
6. Rechecked the spacing of the stripper plates with the gauge and, if possible, field tested the machine.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 177

TASK

Adjust table balance springs.

STANDARD OF PERFORMANCE OF TASK

Table must float properly as specified in the service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Harvester

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, p. 102.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Massey-Ferguson 300 Combine Operator's Manual**, page 102.
2. Have students identify combine elevator table and related parts.
3. Have students explain why combine elevator table must float properly.
4. Have students list 3 safety precautions needed when making table adjustment.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 177

CRITERION-REFERENCED MEASURE

Questions

1. As a general rule, the table auger requires a ________ clearance for light crops.
2. Balance adjustments should be made ________ on both sides of table.
3. ________ table adjustment will cause grain to not flow evenly into table auger.

Answers

1. closer
2. equally
3. Uneven

Practical Application

Have students adjust table balance springs on a combine according to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 177 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 177

ADJUSTING TABLE BALANCE SPRINGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed parts to gain access to balance springs.		
3. Turned balance spring nut in or out to specified torque.		
4. Turned on machine and checked operation.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 178

TASK

Lubricate feeder chain.

STANDARD OF PERFORMANCE OF TASK

All chain links must be evenly lubricated.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Combine or harvester
Mechanic's tool set
Service manual
Proper chain lubricant

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Massey-Ferguson Co. **Massey-Ferguson 300 Combine Operator's Manual**, p. 76.

TEACHING ACTIVITIES

1. Have students read and discuss, textbook, **Massey-Ferguson 300 Combine Operator's Manual**, page 76.
2. Have students identify feeder chain and related sprockets.
3. Have students list the type of lubricants used on chain.
4. Explain the procedure for daily lubrication of chains.
5. Explain the procedure for seasonal lubrication and storage of chains.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 178

CRITERION-REFERENCED MEASURE

Questions

1. The recommended usage period for removing chains for cleanliness and lubrication is ______ hours of use.

2. Complete chain lubrication cannot be achieved when the chain is in ______.

3. ________ is a good solvent to clean chains.

Answers

1. 30
2. operation
3. Kerosene

Practical Application

Have students lubricate feeder chain according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 178 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 178

LUBRICATING FEEDER CHAIN

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for procedure for particular machine.		
2. Removed necessary hardware to gain access to the feeder chain.		
3. With machine stopped, applied lubricant to feeder chain so that all chain links were lubricated.		
4. Replaced hardware, if removed, and ran feeder chains to thoroughly spread the lubricant onto the chain links.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENT OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 179

TASK

Adjust slip clutches.

STANDARD OF PERFORMANCE OF TASK

Clutches must be adjusted and operate according to the manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Combine

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Sperry New Holland Corp. **New Holland 962 Corn Head Service Manual,** p. 22.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland 962 Corn Head Service Manual**, page 22.
2. Explain how the clutch protects the machine from overload.
3. Have students identify the header slip clutch on a combine.
4. Explain how to torque clutch springs according to manufacturer's recommendations.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 179

CRITERION-REFERENCED MEASURE

Questions

1. A slip clutch is an ______ protection device.
2. The header slip clutch protects the ______ from crop overloads.
3. The compression springs on a header slip clutch should be compressed to ______.

Answers

1. overload
2. header
3. 2 1/8"

Practical Application

Have students adjust slip clutches on a combine according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 179 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 179

ADJUSTING SLIP CLUTCHES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual for specific information and safety procedures.		
2. Inspected clutch to see if clutch spring is the proper length when installed in the working position.		
3. Added or removed shims between the spring and the clutch hub if spring length is incorrect.		
4. Test ran machine and observed to be sure clutches are operating correctly. Readjusted if necessary.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 180

TASK

Replace snapping rolls.

STANDARD OF PERFORMANCE OF TASK

After installation, rolls must be adjusted to specifications and must operate as outlined in the service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Replacement snapping rolls
Combine

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Sperry New Holland Corp. **New Holland 962 Combine Corn Head Service Manual**, p. 25.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland 962 Corn Head Service Manual**, page 25.
2. Have students explain how the snapping rolls strip the corn ears from the stalk.
3. Have students identify the timing marks on snapping rolls.
4. Have students explain how to time snapping rolls for proper machine operation.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 180

CRITERION-REFERENCED MEASURE

Questions

1. The timing marks are located on each _____ _____ at the top end of the snapping roll.
2. The stalk roll knives must be adjusted to maintain a clearance of _____ between the knives and roll blades.
3. The slotted lock nut must be torqued to _____ ft lbs.

Answers

1. spur gear
2. 1/32"
3. 100-105

Practical Application

Have students replace the snapping rolls on a combine corn head according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 180 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 180

REPLACING SNAPPING ROLLS

Student's Name ______________________ Date ____________

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Comolete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual		
2. Raised combine header and support with two independent means. Removed necessary hardware to gain access to snapping rolls.		
3. Removed gears from rear of snapping roll shafts.		
4. Loosened and removed bearing retaining bolts and removed snapping rolls.		
5. Installed new snapping rolls and bearings and reinstalled bearing retainer bolts.		
6. Reinstalled snapping roll gears.		
7. Adjusted snapping roll width according to specifications in service manual.		
8. Replaced all hardware.		
9. Lowered header and operated machine to be certain of proper timing and correct operation.		

APPROVED: YES _____ NO _____

Evaluator's Signature ______________________ Date ____________

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 181

TASK

Time gathering chains.

STANDARD OF PERFORMANCE OF TASK

The unit must operate according to manufacturer's specifications and chains must not contact one another after timing is set.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Combine or harvester

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools

RESOURCE

Sperry New Holland Corp. **New Holland 962 Corn Head Service Manual**, p. 23.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland 962 Corn Head Service Manual**, page 23.
2. Have students identify gathering chains and their related parts.
3. Have students explain the function of the gathering chain guides.
4. Have students explain how tension is maintained on the gathering chains.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 181

CRITERION-REFERENCED MEASURE

Questions

1. The gathering chains should be timed so that the legs are no more than ______ apart.
2. Gathering chain guides are adjusted so there is ______ clearance between the chain and guide.
3. The chain tension is correct when the compressed length of the chain is ______.

Answers

1. 3/4"
2. 1/16"
3. 5 1/16"

Practical Application

Have students time gathering chains on a corn head according to the manufacturer's specification.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 181 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 181

TIMING GATHERING CHAINS

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service manual for specific instructions and safety procedures.		
2. Raised the gather sheets to gain access to the gathering chains.		
3. Pulled the gathering chain sideways to release the gathering chain spring.		
4. Used a special spring lock provided by the manufacturer or a pair of locking grip pliers, lock the spring in this position.		
5. Removed chains for timing.		
6. Timed chains so that chain flights do not contact each other on side-by-side chains.		
7. Adjusted the space between flights to the manufacturer's specification.		
8. Unlocked spring to produce tension on the gathering chain.		
9. Rechecked timing and replaced gather sheets.		
10. Checked operation of the unit by field testing.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 182

TASK

Replace cutterbar on mower-conditions/windrower.

STANDARD OF PERFORMANCE OF TASK

The new cutterbar must operate freely without binding according to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mower-conditioner
Mechanic's tool set
Service manual
Cutterbar

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Sperry New Holland Corp. **New Holland Haybine 479 Mower-Conditioner Operator's Manual**, p. 19.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland Haybine 479 Mower-Conditioner Operator's Manual**, page 19.
2. Have students list three safety precautions to observe when replacing cutterbar on mower-conditioner.
3. Have students explain the cutting action of the cutterbar.
4. Have students describe the knife-head bolt used to secure cutterbar.
5. Have students describe proper knife-guard register.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 182

CRITERION-REFERENCED MEASURE

Questions

1. The cutterbar head bolt is a grade ______ specially hardened bolt.
2. The knife head area must be perfectly ______.
3. The cutterbar head bolt should be tightened to ______ ft. lbs. of torque.

Answers

1. 8
2. straight
3. 80-85

Practical Application

Have students replace the cutterbar on a mower-conditioner according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 182 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 182

REPLACING CUTTERBAR ON MOWER-CONDITIONER WINDROWER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service manual.		
2. Removed necessary shields to gain access to cutterbar drive.		
3. Removed bolt holding cutterbar to drive.		
4. Removed cutterbar by sliding it out.		
5. Replaced with new cutterbar.		
6. Reinstalled bolt to drive mechanism.		
7. Replaced all shields.		
8. Operated the cutterbar, turning the drive by hand and checked for binding.		
9. Operated at correct RPM.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 183

TASK

Replace guard on mower-conditioner/windrower.

STANDARD OF PERFORMANCE OF TASK

The cutterbar must operate freely without binding.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mower-conditioner
Mechanic's tool set
Service manual
Replacement cutterbar guard

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Sperry New Holland Corp. **New Holland 479 Haybine Mower-Conditioner Service Manual**, p. 20.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **New Holland 479 Haybine Mower-Conditioner Service Manual**, page 20.
2. Have students explain proper guard and cutterbar register.
3. Have students describe proper guard alignment.
4. Have students demonstrate how to strike guard for proper alignment.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 183

CRITERION-REFERENCED MEASURE

Questions

1. Guards should be aligned so the knife section is resting on the guard ______.
2. Guard wings should be ______ to the knife back.
3. Guard should be replaced when the corners of the ledger surface become ______ or ______.

Answers

1. ledger surface
2. parallel
3. rounded, dull

Practical Application

Have students replace guards on mower-conditioner/windrower according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 183 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 183

REPLACING GUARDS ON MOWER-CONDITIONER WINDROWER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Removed necessary shields to obtain access to cutterbar.		
3. Removed cutterbar drive bolt and removed cutterbar.		
4. Removed bolts holding guard in place and removed guard.		
5. Bolted new guard in place.		
6. Replaced cutterbar and checked for freedom from binding or unnecessary contact with guard.		
7. Adjusted guard as necessary and tightened bolts.		
8. Replaced shields.		
9. Operated machine at correct RPM and checked for abnormalities.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 184

TASK

Replace hay conditioner universal joints.

STANDARD OF PERFORMANCE OF TASK

The unit must work smoothly with freedom from binding or severe operating angles.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Hay conditioner needing universal joints
Mechanic's tool set
Service manual
Replacement universal joints

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agricultural Power and Machinery**, pp. 152-53.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agriculture Power and Machinery**, pages 152-53.
2. Have students discuss the four causes of universal joint malfunction.
3. Have students list the two types of universal joints used on most agricultural machines.
4. Have students list four checks for abnormal universal joint operation.
5. Show how to remove snap rings and bearing cups from universal joints.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 184

CRITERION-REFERENCED MEASURE

Questions

1. Maintenance of the universal joints primarily involves servicing the ______.
2. ______ ______ is a sign of universal joint failure.
3. Lack of ______ will cause bearing failure.

Answers

1. bearing
2. noisy operation
3. lubrication

Practical Application

Have students replace hay conditioner universal joints according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 184 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 184

REPLACING HAY CONDITIONER UNIVERSAL JOINTS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted the service manual.		
2. Removed all shields to gain access to drive shaft.		
3. Removed drive shaft.		
4. Removed snaprings holding joint together.		
5. Removed the universal joint cross from the shaft.		
6. Replaced the joint and snaprings.		
7. Remounted drive shaft on the machine and lubricated the joint.		
8. Checked alignment of shaft and freedom of movement.		
9. Connected shaft to power source.		
10. Operated at correct RPM and checked for freedom from binding or severe angles.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 185

TASK

Replace knife sections on mower-conditioner/windrower.

STANDARD OF PERFORMANCE OF TASK

The new knife sections must be tight and in correct alignment with other knife sections as specified in service manual.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mower-conditioner
Mechanic's tool set
Service manual
Replacement knife sections

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, pp. 463-64.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 463-64.
2. Explain how to remove broken or damaged knives from bar assembly.
3. Show how to fasten new knives to bar assembly using rivets.
4. Have students explain why each knife must register properly with guards.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 185

CRITERION-REFERENCED MEASURE

Questions

1. Care must be taken when removing knife sections not to bend the ______.
2. The rivet heads should be formed with a ______ ______.
3. If a knife bar becomes bent, it may be straightened in a ______.

Answers

1. bar
2. rivet set
3. vise

Practical Application

Have students replace knife sections on a mower-conditioner/windrower according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 185 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 185

REPLACING KNIFE SECTIONS ON MOWER-CONDITIONER/WINDROWER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual		
2. Removed necessary shields to gain access to cutterbar.		
3. Removed cutterbar drive bolt and removed cutterbar.		
4. Inspected cutterbar and determined which knife sections need replacing.		
5. Removed the rivets holding the knife to the cutterbar.		
6. Removed the knife section.		
7. Removed other half of rivet from the cutterbar using a punch.		
8. Installed new knife section.		
9. Installed new rivets.		
10. Braded out the rivets.		
11. Checked for tighteness and alignment of knife section.		
12. Reinstalled cutterbar on machine and installed drive bolt.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 185

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Replaced shields.		
14. Operated at correct RPM and checked operation of cutterbar.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 186

TASK

Replace ledger plates on mower.

STANDARD OF PERFORMANCE OF TASK

Ledger plates must be adjusted according to manufacturer's specifications and cutterbar must operate smoothly with freedom from binding and excessive contact.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Mower
Mechanic's tool set
Service manual
Jack stands
New ledger plates

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, pp. 461-62.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 461-62.
2. Have students explain the function of the ledger plates on a mower.
3. Show how to remove worn ledger plate from guard.
4. Demonstrate how to install new ledger plate in the guard using rivets.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 186

CRITERION-REFERENCED MEASURE

Questions

1. The ledger plates in the guards form one of the ______ ______.
2. The ledger plates are fastened to the guards by ______.
3. A ______ may be used to tighten the rivets in the ledger plate.

Answers

1. cutting edge
2. rivets
3. punch

Practical Application

Have students replace ledger plates on a mower according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 186 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 186

REPLACING LEDGER PLATES ON MOWER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual for safety procedures.		
2. Removed necessary guards or shields to gain access to the mower cutterbar.		
3. Removed bolts holding ledger plates in place and removed ledger plate.		
4. Installed new ledger plates and adjusted to manufacturer's specification.		
5. Replaced guards or shields if removed and checked operation of the machine.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF COMBINES AND HARVESTERS

PERFORMANCE OBJECTIVE 187

TASK

Replace wear plates on mower.

STANDARD OF PERFORMANCE OF TASK

Cutterbar must operate smoothly with freedom from binding or unnecessary contact with other parts. Wear plates must be adjusted to manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Sicklebar mower or mower-conditioner
Jack stands
Mechanic's tool set
Service manual
Wear plates

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, p. 461.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, page 461.
2. Have students identify wearing plates on a mower.
3. Have students explain the function of wearing plates on mower.
4. Show how to adjust wearing plates for proper mower cutting action.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 187

CRITERION-REFERENCED MEASURE

Questions

1. The back of the mower knife rubs against ______ ______.
2. Wearing plates are adjusted by moving them ______.
3. Worn wear plates allow excessive ______ in the knife.

Answers

1. wear plates
2. forward
3. play

Practical Application

Have students replace wear plates on a mower according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 187 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 187

REPLACING WEAR PLATES ON MOWER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed necessary shields to gain access to cutterbar.		
3. Placed cutterbar in the raised position for mower-conditioners and support with jack stands. For sicklebar mowers, block up cutterbar parallel to the floor.		
4. Removed bolts holding wear plates in place.		
5. Removed wear plates.		
6. Installed new wear plates.		
7. Adjusted wear plates to give proper cutterbar clearance.		
8. Replaced shields.		
9. Checked operation, turning by hand.		
10. Attached machine to power source and checked for operation and freedom from binding and excessive contact.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

SERVICING MECHANICAL COMPONENTS OF PLANTERS

DUTY SERVICING MECHANICAL COMPONENTS OF PLANTERS

PERFORMANCE OBJECTIVE 188

TASK

Replace disc cover, furrow cover, corn planter.

STANDARD OF PERFORMANCE OF TASK

The unit must be adjusted to and in accordance with manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service or assembly manual
Mechanic's tool set
Planter
Replacement disc furrow cover

ENABLING OBJECTIVES

1. Read and interpret service or assembly manual.
2. Select and use basic mechanic's tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, pp. 434-40.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 434-440.
2. Have students identify disc furrow cover and related parts on corn planter.
3. Have students inspect disc furrow cover for wear.
4. Have students adjust disc furrow cover for different working depth.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 188

CRITERION-REFERENCED MEASURE

Questions

1. The ______ of the disc may be charged to throw various amounts of soil.
2. The ______ ______ determines the depth of furrows.
3. Setting the furrowers up or down determines the ______ that seed will be planted.

Answers

1. angle
2. adjusting pin
3. depth

Practical Application

Have students replace disc furrow cover on a corn planter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 188 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 188

REPLACING DISC FURROW COVER, CORN PLANTER

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service or assembly manual.		
2. Removed guard or shields, if necessary, to gain access to disc.		
3. Removed bolts holding disc to hub.		
4. Removed disc.		
5. Installed new disc and replaced bolts.		
6. Reinstalled guards and shields, if removed.		
7. Adjusted the disc furrow cover to manufacturer's specifications.		
8. Checked the disc for correct operation and adjust it, if necessary.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF PLANTERS

PERFORMANCE OBJECTIVE 189

TASK

Replace press wheel furrow cover on a corn planter.

STANDARD OF PERFORMANCE OF TASK

Press wheel must be adjusted to manufacturer's specifications and must operate freely.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Corn planter
Mechanic's tool set
Service manual
New press wheel

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Phipps. **Mechanics in Agriculture**, pp. 434-40.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 434-40.
2. Have students identify press wheel furrow cover and related parts.
3. Have students describe a situation when a press wheel furrow cover might be preferred over a disc cover.
4. Have students adjust press wheel furrow cover for different working conditions.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 189

CRITERION-REFERENCED MEASURE

Questions

1. The press wheel furrow cover is used to ______ the seed into the soil.
2. ______ are used to apply pressure to press wheels.
3. There are ______ types of press wheel furrow covers.

Answers

1. press
2. Springs
3. two

Practical Application

Have students replace press wheel furrow cover on a corn planter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 189 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 189

REPLACING PRESS WHEEL FURROW COVER ON A CORN PLANTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted service manual.		
2. Supported implement so that press wheel is free.		
3. Loosen bolts holding press assembly to main frame of machinery.		
4. Removed chain idler and chain from wheel sprocket.		
5. Removed press wheel bolts and lowered wheel out of frame.		
6. Removed gear and axle assembly from wheel and placed in the new wheel, if old axle is to be used.		
7. Installed new press wheel and adjusted to manufacturer's specifications.		
8. Retightened all bolts and replaced chain and chain idler.		
9. Checked operation of unit.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF PLANTERS

PERFORMANCE OBJECTIVE 190

TASK

Replace hitches on corn planter.

STANDARD OF PERFORMANCE OF TASK

Hitches must be aligned and must operate in accordance with manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Assembly manual
Mechanic's tool set
Corn planter
Hitch assembly

ENABLING OBJECTIVES

1. Read and interpret service and assembly manuals.
2. Select and use basic mechanic's tools.

RESOURCE

Allis-Chalmers Tractor Div. **Allis-Chalmers Model 70 Planter Service Manual**, p. 8.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Allis-Chalmers Model 70 Planter Service Manual**, page 9.
2. Have students list the two types of planter hitches.
3. Have students explain how to level the planter hitches.
4. Have students list planting difficulties if planter is not properly hitched.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 190

CRITERION-REFERENCED MEASURE

Questions

1. In order for the planter unit to function properly, the tool bar must be ______ in relation to the ground.
2. If adjusted properly, the tool bar is ______ to the ground surface.
3. If the planter is not leveled properly, the seed will not be placed at the proper ______.

Answers

1. tilted
2. 90 degrees
3. depth

Practical Application

Have students replace hitches on a corn planter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 190 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 190

REPLACING HITCHES ON CORN PLANTER

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service or assembly manual.		
2. Removed bolts holding hitch assembly in place and removed hitch assembly.		
3. Mounted new hitch assembly on machine and bolted in place.		
4. Checked the operation by attaching to a tractor tool bar. Checked for alignment and security.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF PLANTERS

PERFORMANCE OBJECTIVE 191

TASK

Replace row marker on corn planter.

STANDARD OF PERFORMANCE OF TASK

Marker must be installed according to manufacturer's specifications and be adjusted to correct row width.

SOURCE OF STANDARD

Writing Team State of Florida

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Corn planter
New marker

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCES

1. Phipps. **Mechanics in Agriculture**, pp. 434-36.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Mechanics in Agriculture**, pages 434-36.
2. Have students explain the function of row markers.
3. Have students adjust row marker for different width of rows.
4. Have students discuss row marker maintenance.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 191

CRITERION-REFERENCED MEASURE

Questions

1. Row markers are used to maintain _____ row widths throughout the field.
2. The _____ of the row marker should be routinely checked for accurate row widths.
3. The planter should have a _____ _____ before actually starting to plant in the field.

Answers

1. uniform
2. length
3. trial run

Practical Application

Have students replace row marker on corn planter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 191 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 191

REPLACING ROW MAKERS ON CORN PLANTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Consulted service manual.		
2. Removed bolts holding marker in place on planter, and removed marker.		
3. Installed new marker and replaced bolts.		
4. Adjusted marker to the correct row width and tightened bolts.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY SERVICING MECHANICAL COMPONENTS OF PLANTERS

PERFORMANCE OBJECTIVE 192

TASK

Replace furrow opener.

STANDARD OF PERFORMANCE OF TASK

Furrow opener must be replaced and adjusted to the manufacturer's specifications.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Mechanic's tool set
Planter and furrow opener

ENABLING OBJECTIVES

1. Read and interpret service manual.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agriculture Power and Machinery**, p. 337.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agriculture Power and Machinery**, page 337.
2. Have students list 3 types of furrow openers.
3. Have students discuss the purpose of furrow openers on planters.
4. Have students discuss the relationship of properly placed seed and seed germination.
5. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 192

CRITERION-REFERENCED MEASURE

Questions

1. Furrow openers place a definite ______ in the soil.
2. ______ wheels are used to control depth of the furrow.
3. ______ are used on no-til planters to cut through trash.

Answers

1. grove
2. Gauge
3. Coulters

Practical Application

Have students replace furrow openers on planter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 192 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 192

REPLACING FURROW OPENERS

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service manual or assembly manual.		
2. Removed bolts holding braces, depth gauge and wear plate assemblies in place and removed assemblies.		
3. Removed bolts holding furrow openers in place and removed furrow openers.		
4. Installed new furrow openers and replaced bolts.		
5. Replaced wear plate, depth gauge and brace assemblies and tightened bolts.		
6. Checked operation of furrow opener for alignment and freedom of movement.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

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DUTY SERVICING MECHANICAL COMPONENTS OF PLANTERS

PERFORMANCE OBJECTIVE 193

TASK

Replace sprockets on plate type planter.

STANDARD OF PERFORMANCE OF TASK

The sprockets must operate freely in connection with their drive chain. Sprocket and chain assemblies must be in specified alignment.

SOURCE OF STANDARD

State of Florida Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Service manual
Assembly manual
Mechanic's tool set
Planter
New sprocket

ENABLING OBJECTIVES

1. Read and interpret service and assembly manuals.
2. Select and use basic mechanic's tools.

RESOURCE

Jacobs and Harrell. **Agriculture Power and Machinery**, pp. 337-39.

TEACHING ACTIVITIES

1. Have students read and discuss textbook, **Agriculture Power and Machinery**, pages 337-39.
2. Have students identify the sprockets on a plate type planter.
3. Have students discuss the routine maintenance of sprockets and chains.
4. Have students relate the importance of proper chain and sprocket alignment.
5. Have students calibrate a planter.
6. Have students demonstrate the performance of the task.

PERFORMANCE OBJECTIVE 193

CRITERION-REFERENCED MEASURE

Questions

1. Planter chains and sprockets must be ______ for proper seed discharge.
2. Chains, sprockets, and shafts should be ______ daily for optimum planter performance.
3. An ______ sprocket maintains proper tension on drive chain.

Answers

1. aligned
2. lubricated
3. idler

Practical Application

Have students replace sprockets on a plate type planter according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist For Performance Objective 193 to determine if the assignment was completed for competency.

CHECKLIST FOR PERFORMANCE OBJECTIVE 193

REPLACING SPROCKETS ON PLATE TYPE PLANTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Consulted the service or assembly manual.		
2. Removed all necessary guards and braces to gain access to sprockets.		
3. Loosened idler sprocket by removing spring.		
4. Removed drive chain.		
5. Removed roll pins or set screw holding sprockets on their shafts.		
6. Slid sprocket off of the shaft.		
7. Installed new sprocket.		
8. Replaced roll pins or set screw.		
9. Replaced drive chain.		
10. Reconnected idler sprocket spring and adjusted idler to proper chain tension.		
11. Checked the operation of the sprockets by operating the unit as a whole. Checked for freedom from binding and corrected alignment of sprockets and chains.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

APPENDICES

APPENDIX A

DUTY/TASK LIST

Project Code: 1251
O.E. Code: 01:0301
D.O.T Code: 624.281-010

APPENDIX A

DUTY/TASK LIST

	DUTY/TASK	PO/Page Number
A.	Assembling Equipment	
01	Assemble primary tillage equipment	1/5
02	Assemble secondary tillage equipment	2/8
03	Assemble planting equipment	3/11
04	Assemble cultivation and weed control equipment	4/14
06	Assemble fertilizing equipment	5/17
07	Assemble corn harvesting equipment	6/20
* 08	Assemble cotton harvesting equipment	--
09	Assemble forage harvesting equipment	7/23
10	Assemble grain harvesting equipment	8/28
11	Assemble hay harvesting equipment	9/29
14	Assemble crop processing equipment	10/32
16	Assemble front loader equipment	11/35
B.	Performing Administrative Functions	
01	Assign jobs	12/39

		DUTY/TASK	PO/Page Number
	02	Complete initial service data on invoice	13/42
	03	Complete service invoice	14/45
	04	Complete work order	15/48
	05	Prepare written cost estimate of repair work for customer	16/51
	06	Interview customer to obtain description of problem	17/54
	07	Obtain in-stock repair parts through catalog search	18/57
	08	Complete requisition to re-order not in-stock repair parts	---
	09	Prepare warranty claims	20/60
C.	Servicing Bearings and Seals		
	01	Realign shaft and bearings	21/64
	02	(C3, C4) Replace anti-friction ball bearings	22/67
	05	Replace dynamic seals	23/70
	06	Replace plain bearing (bushings)	24/73
	08	Replace static seals	25/76
	09	Tighten bearings	26/79
D.	Servicing Conveyance Systems		
	01	(D4, D5) Adjust bar chains	27/83
	02	Adjust belts	28/86
	06	Align chain and sprocket	29/89
	07	Clean and lubricate chain	30/92
	08	Clean sprocket	31/95
	09	Install chain idler	32/98

	DUTY/TASK	PO/Page Number
11	Replace belt sheave	33/101
12	Repair chains	34/105
13	(D15, D17) Replace flat belts	35/108
14	Replace pickup drive belt	36/111
16	Replace sprocket	37/114
20	Replace elevator paddles	38/117
23	Replace speed control	39/120
24	Replace charge pressure control valve, hydrostatic drive	40/123
25	Replace charge pump, hydrostatic drive	41/126
26	Replace directional control valve, hydrostatic drive	42/129
27	Replace high pressure relief valve, hydrostatic drive	43/132
29	Grease mower gearbox	44/135
30	(D48) Install oil gaskets	45/138
31	Install oil seals	46/141
32	Replace clutch friction disk	47/144
33	Replace countershaft	48/147
34	Replace cracked transmission case	49/150
37	Replace planetary gear	50/153
38	Replace shafts	51/156
40	Replace synchronizing unit	52/159
41	(D36) Replace worn gears	53/162
42	Adjust valves	54/165
43	Replace cracked engine block	55/168

	DUTY/TASK	PO/Page Number
44	Replace cylinder head	56/171
45	Repair piston assembly	57/174
46	Replace cylinder head gasket	58/177
49	Recondition valves and valve seats	59/180
51	Cut ridge out of cylinder	60/183
52	Deglaze cylinder	61/186
E.	Servicing Hydraulics	
01	Adjust pressure relief valve	62/190
02	Bleed air from hydraulic system	63/193
03	Change hydraulic filter	64/196
04	Clean and flush hydraulic system	65/199
05	Drain and refill hydraulic system	66/202
06	Hone hydraulic cylinder walls	67/205
07	Replace check valve	68/208
09	Replace hydraulic hoses	69/211
10	Replace hydraulic cylinders	70/214
11	Replace hydraulic fittings	71/217
12	Replace hydraulic lines	72/220
13	Replace hydraulic piston	73/223
14	Replace packing	74/226
15	Service hydraulic motors	75/229
16	(E19) Service hydraulic pumps	76/232
17	Service hydraulic valves	77/235
18	Service internal hydraulic pumps	78/238

DUTY/TASK — PO/Page Number

F. Servicing Carburetion and Fuel Systems

01 Bleed diesel fuel system 79/242
03 Clean diesel fuel injector 80/245
06 (F5) Rebuild carburetor 81/248
07 Replace diesel injection pump 82/251
08 Replace fuel injector nozzles 83/254
09 Replace fuel pump 84/257
10 Replace turbocharger 85/260
11 Check and adjust timing on diesel fuel injection pump 86/263

G. Servicing Cooling and Lubrication System

02 (GI) Rebuild water pump 87/267
03 Seal leaks in cooling system 88/270
05 Replace cooling system thermostat 89/274
06 Replace oil cooler 90/277
07 Replace oil filters 91/280
08 Replace oil pressure guage 92/283
09 Replace oil pumps 93/286
10 Replace radiator 94/292
12 Replace water pump 95/294
13 Rebuild oil pump 96/295

H. Servicing Electrical Systems

01 (H2) Adjust voltage regulator using fixed resistance method 97/299
03 Replace alternator/regulator 98/303
04 Replace amperage guage 99/306

	DUTY/TASK	PO/Page Number
05	Replace diode	100/309
06	Replace generator brushes	101/312
07	Replace alternator heat sink	102/315
08	Polish commutator	103/318
09	Rebuild distributor	104/321
10	Rebuild starter	105/324
11	Replace alternator bearings	106/327
12	Replace distributor points and condenser	107/330
13	Replace ignition coil	108/333
14	Replace ignition distributor	109/336
15	Replace ignition wires	110/339
16	Replace starter armature shaft bushing	111/342
17	Replace starter brushes	112/345
18	Replace starter drive assembly	113/348
19	Replace starter motor	114/351
20	Replace starter motor solenoid	115/354
21	Set breaker point dwell	116/357
22	Set ignition timing	117/360
23	Troubleshoot electrical monitoring system	118/363
I.	Servicing Internal Combustion Engines	
01	Install connecting rods/caps	119/367
02	(50, 17) Install crackshaft	120/371
03	Install main bearings and cap	121/374
04	Install rod bearings	122/378

	DUTY/TASK	PO/Page Number
05	Install timing chain/gear	123/382
06	Replace bearings	124/385
08	Replace dry sleeves	125/388
10	(D47, E8) Replace piston rings	126/391
11	Replace rocker arms	127/394
12	Replace wet sleeves	128/397
13	(I9) Replace piston	129/401
J.	Servicing Tires	
02	(JI) Demount large implement tire without machine	130/406
03	Demount small implement tire with tire mounting/demounting machine	131/410
04	Demount small implement tire without tire mounting/demounting machine	132/413
05	(J06) Demount tubeless off-road tire	133/416
07	(J8) Mount large implement tire	134/419
10	Repair tire puncture, regular method seal	135/422
11	Seal tire puncture, simscrew method	136/425
12	Service fluid tires	137/428
K.	Servicing Mechanical Components of Balers	
06	Replace compression roll spring round baler	138/432
07	Replace floor and floor channels, round baler	139/435
08	Replace rollers, round baler	140/438
09	Adjust knife arm, twine baler	141/441

	DUTY/TASK	PO/Page Number
10	Adjust knives, twine baler	142/444
11	Adjust needles, twine baler	143/447
12	Adjust slip clutches (drive line and pickup drive), twine baler	144/451
13	Adjust tucker (twine) fingers, twine baler	145/454
14	Adjust twine disk, twine baler	146/458
15	Increase bale care tension, twine baler	147/461
17	Replace bill hook, twine baler	148/464
18	Replace haydog springs	149/467
19	Replace lost or sheared pin in bill hook pinion, twine baler	150/470
20	Replace twine finger rod, twine baler	151/473
21	Replace twine knife, twine baler	152/476
22	Sharpen twine knife cutting edge, twine baler	153/479
31	Time feeder	154/482
32	Time plunger	155/485
33	Replace belts (round baler)	156/488
L.	Servicing Mechanical Components of Combines and Harvesters	
01	Stablize leveling mechanism	157/492
02	Replace concave	158/495
03	Replace cutterbar	159/498
04	Replace feeder conveyor	160/501
05	Replace gathering chains	161/504

	DUTY/TASK	PO/Page Number
06	Replace grain head/corn head rotary axial combine	162/507
07	Replace rotor(s) on rotary or axial combine	163/510
08	Replace snapping plates	164/514
09	Replace straw walkers	165/517
10	Replace threshing cylinder	166/520
11	Replace threshing fans	167/524
12	Adjust cylinder to concave, corn harvester	168/527
13	Adjust cylinder cut-off bar	169/530
14	Adjust drag links	170/533
15	Adjust elevator chains	171/536
16	Adjust floating shoes	172/539
17	Adjust reel speed	173/542
18	Adjust sieves	174/545
19	Adjust snapping rolls	175/548
20	Adjust stripper plates	176/551
21	Adjust table balance springs	177/554
25	Lubricate feeder chain	178/557
26	Adjust slip clutches	179/560
30	Replace snapping rolls	180/563
32	Time gathering chains	181/566
35	Replace cutterbar on mower-conditioner/windrower	182/569
36	Replace guards on mower-conditioner/windrower	183/572

	DUTY/TASK	PO/Page Number
39	Replace hay conditioner universal joints	184/575
40	Replace knife sections on mower-condition/windrower	185/578
41	Replace ledger plates on mower	186/582
42	Replace wear plates on mower	187/585
M.	Servicing Mechanical Components of Planters	
01	Replace disc cover, furrow cover, corn planter	188/589
02	Replace press wheel furrow cover, corn planter	189/592
03	Replace hitches on corn planter	190/595
04	Replace marker on corn planter	191/598
14	Replace furrow opener	192/601
19	Replace sprockets, plate type planter	193/604

APPENDIX B

APPENDIX B

DEFINITION OF TERMS

A number of terms frequently used in this guide may be unfamiliar to the reader; others may be familiar, but in the context of this handbook have been assigned special meanings.

AFFECTIVE.
Skills which emphasize an attitude, feeling, emotion, or degree of acceptance and rejection.

CATALOG.
A comprehensive collection of performance objectives, performance guides, and related data developed in a specific domain.

CBVE (COMPETENCY-BASED VOCATIONAL EDUCATION).
A methodology of instruction that (a) identifies the abilities and skills needed for on-the-job performance; (b) informs students and teachers of the precise and detailed learning objectives required to achieve these competencies; (c) emphasizes performance standards in testing, course requirements, and/or graduation; and (d) facilitates learning by letting each student master the tasks prior to advancing to another.

CHECKPOINT.
A point in the development of the V-TECS product when material must be sent to V-TECS central office for quality review.

CIP (CLASSIFICATION OF INSTRUCTION PROGRAM) CODE.
A code developed by the U.S. Office of Education to identify a specific cluster of related jobs for training program identification.

COGNITIVE.
Skills which emphasize the recall of knowledge and development of intellectual abilities.

COMPETENCY.
Proficiency in the knowledge and skills required of workers in a particular occupation or occupational specialty; a term used by educators to mean essentially program goal, duty, task, or objective. In some cases the terms are essentially synonymous.

CONDITIONS.
Describes the situation for competent task performance, including tools and equipment to be used, and limitations under which the tasks will be performed.

CONSORTIUM.
A group of state agencies, institutions, or other entities which have been legally constituted through letters of commitment, agreements, or by assignment of higher authorities to work together toward the solution of problems in education. A consortium, for the purposes of this work, must have membership from autonomous agencies and institutions which cut across state boundaries as they attempt to solve problems or meet goals.

CRITERION-REFERENCED MEASURES.
An evaluative procedure used to determine if a student has mastered a performance objective.

CROSS-REFERENCE TABLE.
A table that identifies the relationship among duties and tasks found in the occupational inventory and the performance objectives in the final catalog. Also noted are percentages of incumbents performing the tasks by D.O.T.

CURRICULUM GUIDE.
An instructional resource developed from a V-TECS catalog to guide CBVE for an occupation.

DICTIONARY OF OCCUPATIONAL TITLES (D.O.T.).
A document published by the U.S. Department of Labor, Employment and Training Administration. This publication groups occupations into systematic occupational classification structures based on interrelationships of job tasks and requirements.

DISTRACTOR.
An incorrect response to a multiple-choice or true/false test item.

DOMAIN (OCCUPATIONAL DOMAIN).
A group of job titles that are related on the basis of required skills and knowledge.

D.O.T. CODE.
A nine-digit number used to identify a specific job within a given calendar year.

DUTY.
A cluster of related tasks performed by incumbent workers in an occupational domain.

ENABLING OBJECTIVE.
An objective related to background knowledge or skills that are prerequisite to the mastery of a given task.

FIELD REVIEW.
The process of using and refining drafts of V-TECS materials for the purpose of identifying content errors or technical problems.

GUIDE SHEET.
Instructional information including the duty, performance objective, task, performance of standard, survey of standard, conditions for performance of task, enabling objectives,resources, teaching activities, criterion-referenced measures, and performance guide.

JOB.
A group of tasks performed by a job incumbent.

JOB INCUMBENT.
An individual who is currently employed in an occupation.

OCCUPATIONAL ANALYSIS (Task Analysis).
The process of reviewing elements of a job for the purpose of improving training program content across program levels of vocational-technical education.

OCCUPATIONAL INVENTORY(Task Inventory Booklet).
A survey instrument listing tasks performed and tools and equipment used by job incumbents in an occupational domain.

OCCUPATIONAL SURVEY.
The procedures for collecting data to identify the duties and tasks that comprise one or more jobs, job types, or career field ladders for the collection and analysis of information concerning such duties.

O.E./CIP CODE.
A code developed by the U.S. Office of Education to identify a specific cluster of related jobs for training program identification.

PERFORMANCE-BASED INSTRUCTION.
Instruction which requires the learners demonstration of specific competencies. The desired abilities are selected before the instruction is described and are clearly defined as observable performance objectives.

PERFORMANCE CHECKLIST.
A list of performance steps derived from the performance guide to record acceptable or unacceptable performance of each step of a task.

PERFORMANCE GUIDE (PG).
A series of steps required for performance of a task arranged in the sequence ordinarily followed.

PERFORMANCE OBJECTIVE (PO).
A statement, in precise measurable terms, of a particular behavior to be exhibited by a learner under specified conditions, including a standard of performance.

PSYCHOMOTOR.
Skills which emphasize manipulation of material or tools.

QUALITY REVIEW.
A review of content by V-TECS staff or designated representative to examine quality of content, format, and style of V-TECS product(s).

RESOURCES.
Materials which are used to develop instruction and/or learner-specific objectives.

SOURCE OF STANDARD.
A person or origin from which the information establishing the standard is received.

STANDARD.
The criteria used to determine if a task has been successfully or unsuccessfully performed.

STATE-OF-THE-ART REFERENCE.

Current materials from which information or resources can be found to facilitate instruction.

STATE-OF-THE-ART (SOA) STUDY.

Research conducted to determine the current status of performance-based instructional materials and practices in the domain area under study and to obtain other information that might be useful in catalog development.

SUBJECT-MATTER EXPERT.

A highly experienced person (incumbent worker/instructor) who assists in identifying task performance steps, skills, and knowledge necessary to perform the job.

TASK.

A unit of work activity which constitutes logical and necessary steps in the performance of a duty. A task has a definite beginning and ending point in its accomplishments and generally consists of two or more definite steps.

TASK ANALYSIS.

The process of reviewing elements of a job for the purpose of improving training program content across program levels of vocational technical education.

TASK LIST.

A list of tasks performed by incumbents in a specific occupational domain.

TEACHING ACTIVITIES.

Methods and/or procedures for delivering instructional content to students.

TEST-ITEM BANK.

A collection of criterion-referenced test items coded for input and retrieval by computer or manual methods.

VALIDATION.

The process of assuring that all aspects of an occupational.task analysis identify the skills, knowledge, and attitudes performed in the occupation.

VERIFICATION.

The procedure of collecting data to substantiate an existing product; for example, task list verification.

V-TECS.

An acronym representing: Vocational-Technical Education Consortium of States; 795 Peachtree Street, N.E., Atlanta, Georgia 30365. A consortium of states that provide competency-based, vocational-technical education materials while conserving time and money through shared development and dissemination.

V-TECS CATALOG.

An incumbent-based description of the duties, tasks, performance objectives, performance guides, and related data in a specified occupation.

WORKING CONDITIONS.

The atmospheric and environmental conditions under which a worker performs a specific job.

WRITING TEAM.

A team of people representing instructors with subject matter expertise; persons having knowledge and experience in developing criterion-referenced measures; local or state supervisors in the domain being developed; workers and supervisors of incumbent workers whose function is to analyze occupational data and develop performance objectives for specific D.O.T. areas.

APPENDIX C

APPENDIX C

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
* Socket Set (1/2" Drive, Deep Well)	98.77	80.
Gear and Pulley Pullers	97.53	79.
Goggles, Safety	97.53	79.
* Hammer, Ball Peen (Assorted)	97.53	79.
* Screwdriver Set, Standard	97.53	79.
* Wrench Set, Allen	97.53	79.
Battery Cell Tester	96.30	78.
Battery Charger	96.30	78.
Brooms, Push	96.30	78.
Brushes, Cleaning, Parts	96.30	78.
Drill Bit (Assortment)	96.30	78.
Grease Gun ,Lever Type	96.30	78.
Grinder (10" and 6" Wheels)	96.30	78.
Mechanic's Creeper	96.30	78.
* Wrench Set (Adjustable)	96.30	78.
Air Compressor	95.06	77.
Battery Booster Cable	95.06	77.
Brushes, Wire	95.06	77.
Flaring Tool	95.06	77.
* Plier Set, Snap Ring	95.06	77.
* Plier Set, Vise Grip	95.06	77.
* Pliers, Needle Nose	95.06	77.
* Screwdriver Set, Phillips	95.06	77.
* Wrench, Torque	95.06	77.
Crow Bar	93.83	76.
Pry Bar	93.83	76.
Water Can	93.83	76.
Water Hose	93.83	76.
Battery Terminal Cleaning Tool	92.59	75.
Bearing Pullers	92.59	75.
* Chisel and Punch Set	92.59	75.
Drain Pans	92.59	75.
Face Shield	92.59	75.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Flashlight	92.59	75.
Goggles, Welding	92.59	75.
Grinder, Bench	92.59	75
* Chisel, Cold (Assorted)	91.36	74.
Cylinder Hone	91.36	74.
Gauge, Pressure (Hydraulic)	91.36	74.
* Punch Drift (Assorted)	91.36	74.
* Sockets, Flex (3/8" and Assorted)	91.36	74.
* Spark Plug Sockets	91.36	74.
* Wrench Set, Box End (5/16" - 1 3/4")	91.36	74.
* Wrench Set, Socket, (Various Drives)	91.36	74.
Bolt Cutter	90.12	73.
Clutch Disk Aligning Tool (Universal)	90.12	73.
First Aid Kit	90.12	73.
Gloves, Welding	90.12	73.
Helmets, Welding	90.12	73.
Piston Ring Compressors	90.12	73.
* Punch Center (Assorted)	90.12	73.
Welder, Electric	90.12	73.
Work Bench	90.12	73.
Acetylene Welder, Set with 2-Stage Regulators	88.89	72.
Extension Cords (3-Wire #12 Wire)	88.89	72.
Light, Trouble	88.89	72.
* Sockets, Hex (Deep)	88.89	72.
Welding Clamps, Vise Grip	88.89	72.
Battery Hydrometer	87.65	71.
Gas Can	87.65	71.
Heating Tip	87.65	71
Jack Stand, Adjustable	87.65	71.
Welding Rods	87.65	71.
* Wrenches, Pipe	87.65	71.
Acetylene Tanks	86.42	70.
Adaptors, Hydraulic (Assorted)	86.42	70.
Cylinder Ridge Reamer	86.42	70.
* Pliers, Gripping	86.42	70.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Puller (Assorted)	86.42	70
Punch Set, Roll Pin Removal	86.42	70.
* Socket, Hex (Shallow)	86.42	70.
Tube Cutter	86.42	70.
Vise, Bench	86.42	70.
C-Clamps (6, 8, 12 inches)	85.19	69.
Drill, Electric (3/8 inch) Reversible)	85.19	69.
Fire Extinguisher (General C02)	85.19	69.
Hand Saw, Metal Cutting	85.19	69.
* Retaining Ring Pliers, Internal	85.19	69
Tube Flaring Kit	85.19	69.
Volt, Amp Meter	85.19	69.
Hammers, Sledge (Assorted)	83.95	68.
Metal Files (Assorted)	83.95	68.
* Punch, Lining Up	83.95	68.
Ring Groove Cleaning Tool	83.95	68.
Valve Grinding Compound	83.95	68.
Alternator Regulator Tester	82.72	67.
Battery Carrier	82.72	67.
Cylinder Wall Deglazer (Various Sizes)	82.72	67.
Grinder, Electric Disc	82.72	67.
* Hammers, Chipping	82.72	67.
Jack, Hydraulic (12 ton cap)	82.72	67.
Piston Ring Expanders	82.72	67.
Retaining Ring Pliers, External	82.72	67.
Spark Plug Gauge, Wire	82.72	67.
Tire Gauge, Wet Type	82.72	67.
Welding And Cutting Outfit	82.72	67.
A-Frame Hoist	81.48	66.
Drill, Electric (1/2 inch Reversible)	81.48	66.
Rethreader Set (NF and NC 1/4" - 1/2")	81.48	66.
Tester, Hydraulic	81.48	66.
Valve Spring Compressor	81.48	66.
Compression Tester (14 mm and 18 mm Adapters)	80.25	65.
Drill, High Speed	80.25	65

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
* Pliers, Hose Clamp	80.25	65.
Puller, Universal	80.25	65.
* Screwdriver, Offset	80.25	65.
Soldering Gun, Electric	80.25	65.
Welding Tip	80.25	65.
Wheel Puller	80.25	65.
Dial Indicator	79.01	64.
Drill Press, High Speed	79.01	64.
Knives, Putty	79.01	64.
Oil Waste Can	79.01	64.
* Punch, Drive	79.01	64.
Battery Cable Puller	77.78	63.
Battery Terminal Spreader	77.78	63.
Caliper, Micrometers (Assorted)	77.78	63.
Cylinder Head/Valve Seat Resurfacing Tools	77.78	63.
Pressure Gauge, Hydraulic (0-10.000)	77.78	63.
Ratchet Adaptor	77.78	63.
Ring Expander Tool	77.78	63.
Terminal Kits, Solderless	77.78	63.
Chains, Log	76.54	62.
Gear Lubricant Dispenser	76.54	62.
Magnetic Pick-Up Tool	76.54	62.
* Pliers Set	76.54	62.
Valve Grinding Machine	76.54	62.
* Wrench, Hex Head	76.54	62.
Air Hose With Guide Couples	75.31	61.
Bushing, Driver set, Regular	75.31	61.
Feeler Gauge	75.31	61.
Oxygen Tanks	75.31	61.
Punch, Long Drift	75.31	61.
* Ratchet Box Socket	75.31	61.
Tire Valve Tool Remover	75.31	61.
Valve Seat Grinder	75.31	61.
Calipers, Inside	74.07	60.
Jack, All Purpose (1/2 Ton)	74.07	60.
Bushing Drive, Heavy Duty	72.84	59.
* Hammer, Puller Slide	72.84	59.
Oil Seal Installation Kit	72.84	59.

EQUIPMENT BY PERCENTAGE RATING

	Equipment Description	Percentage of Members Using	Number of Members Using
	Punch, Pin (Assorted)	72.84	59.
	Saw, Hack (Power)	72.84	59.
	Tank, Parts Cleaner	72.84	59.
	Wrecking Bar, Gooseneck	72.84	59.
*	Plier, Joint Gripping (9 1/2" Long)	71.60	58.
	Ridge Reamer (3-5)	71.60	58.
	Battery Terminal Puller	69.14	56.
*	Chisel, Long, Flat (Assorted)	69.14	56.
	Calipers, Outside	67.90	55.
	Dwell Tach Tester	67.90	55.
	Gasket Maker	67.90	55.
	Grinder Sander	67.90	55.
	Valve Guide Cleaner	67.90	55.
	Engine Stand	66.67	54.
*	Hammer, Soft Face	66.67	54.
	Jar Lapping Compound	66.67	54.
	Pipe Cutter	66.67	54.
*	Plier, Ingnition	66.67	54.
*	Socket Set, Midge	66.67	54.
	Tool Kit, Ignition	66.67	54.
	Vise, Machinist (4" Jaws)	66.67	54.
	Funnel, Lock on	65.43	53.
	Vise, Machinist (5" Jaws)	65.43	53.
	Air Dusting Gun	64.20	52.
	Hydrometer, Radiator	64.20	52.
	Pump Tester	64.20	52.
	Brooms, Whisk	62.96	51.
	Cleaning Kit, Injector	62.96	51.
	Mirror, Inspection	62.96	51
	Wrenches, Flare Nut	62.96	51.
	File, Point	61.73	50.
	Mill File Double Cut (Assorted)	61.73	50.
	Test Kit, Electric	61.73	50.
	Tire Removing Tools, Curved	61.73	50.
	Wrecking Bars (Assorted)	61.73	50.
*	Wrench, Adjustable (Click Stop)	61.73	50.
	Drill Grinding Attachment	60.49	49.
	Torquemeter	60.49	49.
	Vacuum Gauge	60.49	49.
	Valve Guide Driver Set	60.49	49.
	Cylinder Gauge (Assorted)	59.26	48.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Extension Bar (Various Sizes)	59.26	48.
Oil Measure (1 and 2 Quart Capacity)	59.26	48.
Pipe Threader Set	59.26	48.
Armature Growler (120 Volts AC 60 Cycle)	58.02	47.
Armature Tester	58.02	47.
Caliper, Rule (Co-Pocket Slide)	58.02	47.
Drill Bit Set, Wire Gauge	58.02	47.
Lifting Eyebolts and "S" Hocks (Assorted)	58.02	47.
Micrometer (Inside)	58.02	47.
Tubing Bender	58.02	47.
Drill Press Vise	56.79	46.
Gun, Pressure	56.79	46.
* Hammer, Plastic	56.79	46.
* Mallet, Rubber	56.79	46.
Oilers (1/2 Pint Capacity, 5" Spout)	56.79	46.
* Punch Set, Hollow	56.79	46.
Square, Combination	56.79	46.
Tune-Up Kit	56.79	46.
* Chisel, Half-Round Nose	55.56	45.
Lubrication Gun, High Pressure	55.56	45.
Micrometer Depth Gauge	55.56	45.
* Chisel, Cape	54.32	44.
Clevis, Twisted and Straight	54.32	44.
Diagonal Cutter	54.32	44.
Pilot Bearing Jaw	54.32	44.
Wash rack, Elevated	54.32	44.
Wire Wheel with Stem for Drill	54.32	44.
Diesel, Nozzle Cleaning Kit	53.09	43.
Hoist, High Speed, 2 Tons	53.09	43.
Rule, Depth Gauge	53.09	43.
* Screwdriver Set, Spark Tester	53.09	43.
Tire Removing Tool, Straight	53.09	43
Wheel Puller Adapter	53.09	43.
Blind Bearing Puller	51.85	42.
Brushes, Wire Cap (Assorted)	51.85	42.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Carbon Brush, Standard	51.85	42.
Extension Cords 239 AMP	51.85	42.
File Handles	51.85	42.
Grinding Wheel Dressing Tool	51.85	42.
* Hammer, Lead (2 lbs.)	51.85	42.
Jack, Lo-Lift Transmission (200 lbs., Capacity)	51.85	42.
Wheel Dolly	51.85	42.
Anvil (150 lbs, and Accessories)	50.62	41.
Arch Rods	50.62	41.
Pop Rivet Gun Set	50.62	41.
* Wrench Electric Impact	50.62	41.
Bearing Separator	49.38	40.
Main Bearings Remover	49.38	40.
* Screw Starter	49.38	40.
Carbon Scrapper, Bent	48.15	39.
Coil Tester	48.15	39.
* Hammer, Tire Combination	48.15	39.
Paint Brushes (Assorted)	48.15	39.
Radiator Pressure Cap Tester	48.15	39.
Ratchet Spinner	48.15	39.
Battery Service Kit	46.91	38.
Chisel Kit, Power	46.91	38.
Floor Press Set with Accessories	46.91	38.
Reamers, Adjustable	46.91	38.
Safety Cans	46.91	38.
Caliper, Vernier	45.68	37.
Pop Rivet Kit	45.68	37.
* Sockets, Hex (Double)	44.44	36.
* Chisel, Diamond Point	43.21	35.
Engraving Tool, Electric	43.21	35.
Gear Case Cleaner, Flexible	43.21	35.
Lubrication Fitting Drives	43.21	35.
Master Torch and Cylinder	43.21	35.
Piston Pin Press Set	43.21	35.
Spark Tester	43.21	35.
Wet Valve Refacer	43.21	35.
Carbon Brush, Spiral Twist	41.98	34.
Valve Spring Tester	41.98	34.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Wheel Bearing Packer	41.98	34.
Ball Bearing Trolley	40.74	33.
Drill Pneumatic	40.74	33.
* Hammer, Engineer	40.74	33.
Spark Plug Cleaner	40.74	33.
Tubeless Valve Stem, Installing Tool	39.51	32.
Valve Key Replacer	39.51	32.
Wheel Dressing Attachment (with Diamonds)	39.51	32.
File Cabinet	38.27	31.
Speeder	38.27	31.
Sand Blaster	38.27	31.
Pipe Vise Cap	37.04	30.
Reamer Pipe (Capacity 1/4" - 2")	37.04	30.
Oil Stone	35.80	29.
Vise, Grip Bending Tools	35.80	29.
Ignition Coil Tester, Small Engine	34.57	28.
Ram, Hydraulic (12 ton)	34.57	28.
Grinding Pedestal with Coolant Bucket	33.33	27.
Level (18" aluminum)	33.33	27.
Wheel Sliding Tool	33.33	27.
* Mallet, Plastic (2 lbs.)	32.10	26.
Handles, Plastic	30.86	25.
Magneto Tester, Small Engine	30.68	25.
Flat Door Scraper	29.63	24.
Dividers (Assorted)	28.40	23.
File Card and Brush	28.40	23.
Oilers, Small Pressure	28.40	23.
Respirators	28.40	23.
Air Transfer	27.16	22.
Service Kit, Small Engine	27.16	22.
Valve Seat Cart	27.16	22.
Nut Spinner Head	25.93	21.
Nut Spinners	25.93	21.
Yoke (Assorted)	25.93	21.
Cylinder Trucks	24.69	20.
Floor Light Eye Shield	24.69	20.
Center Gauge	23.46	19.
Oilers, Pressure	23.46	19.
Screw Pitch Gauges	23.46	19.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Exhaust Hose	22.22	18.
Grip it Tool (8"Flexible)	22.22	18.
Load Motor (400 lbs. Capacity)	22.22	18.
Cement Form	20.99	17.
Crack Detector (3/4 inch Drive)	20.99	17.
Plastic Apron or Jacket, Welding	20.99	17.
Fire Blanket	19.75	16.
Lapping Blocks Set	19.75	16.
Tire Tester Tank	19.75	16.
Calibration Jacks, Plastic	18.52	15.
Cap, Screw Cross Arm	18.52	15.
Carbon Brush Cap	18.52	15.
Clamp, I-Bar	18.52	15.
Installer Plates	18.52	15.
Lathe Bit Kit	18.52	15.
Radius Gauge	18.52	15.
Exhaust Gas Analyzer	17.28	14.
Jaws, Reversible (3 1/2")	16.05	13.
Shears, Electric (#16)	16.05	13.
Jaws, Reversible (4 5/8")	14.81	12.
Jaw and Link (Assorted)	13.58	11.
Blacksmith Tong	12.35	10.
Shield, Hand	11.11	9.
Slice Bars	9.88	8.
Callot (1/4 inch - 3/8 inch Stern Capacity)	8.64	7.
Slide Lead	7.41	6.
* Torque Wrench	3.70	3.
Grinding Wheel Shields	2.47	2.
Wash Rack, Unelevated	2.47	2.
* Wrench Set, Box-Open (Combination 5/16 - 1 1/4)	1.23	1.
Tractor Housing and Cab Handler Set	1.23	1.
Press	1.23	1.
Viewer	1.23	1.
Ladies Feet	1.23	1.
Injector Test Bench	1.23	1.
Steam Cleaner	1.23	1.
Oil Filter Wrenches	1.23	1.
8 Point Sockets	1.23	1.
Weatherhead Sockets	1.23	1.
Reel Grinders	1.23	1.
Bedknife Grinders	1.23	1.

EQUIPMENT BY PERCENTAGE RATING

Equipment Description	Percentage of Members Using	Number of Members Using
Blade Grinders	1.23	1.
* 3/4" Drive Sockets and Ratchet Set	1.23	1.
Adapter for Filling Tires with Water	1.23	1.
Gear Installation Kit	1.23	1.
Detroit Diesel Injection Tools Setting (1.460-1.484)	1.23	1.
Feeler Gauges for Setting Detroit Diesel	1.23	1.
Oil Pressure Gauges	1.23	1.
Paint Guns	1.23	1.
* Inpact Screwdriver	1.23	1.
Metric Tool Kit	1.23	1.
Electrical Hazard Test Equipment	1.23	1.
Floor Jack	1.23	1.
Pressure Washer	1.23	1.
Load Motor (2,000 lbs. Capacity)	1.23	1.
Air Wrench	0.0	0.
Flow Rater	0.0	0.
Dynamometer	0.0	0.
Air Sanders	0.0	0.
* Personal Tool Box	0.0	0.
Jack, Hydraulic (8 ton Cap)		
Solderless Terminal Crimping Pliers	0.0	0.

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* Indicates inclusion in mechanic's tool set.

APPENDIX D

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SOURCES OF STANDARDS

1. **Fundamentals of Machine Operation -- Combine Harvesting**. Moline, Illinois: John Deere Service Publications, 1973.
2. **Fundamentals of Service -- Bearings and Seals**. Moline, Illinois: John Deere Service Publications, 1974.
3. **Fundamentals of Service -- Electrical Systems**. 2nd edition. Moline, Illinois: John Deere Service Publications, 1972.
4. **Fundamentals of Service -- Engines**. Moline, Illinois: John Deere Service Publications, 1972.
5. **Fundamentals of Service -- Hydraulics**. Moline, Illinois: John Deere Service Publications, 1967.
6. **Fundamentals of Service -- Tires and Tracks**. Moline, Illinois: John Deere Service Publication, 1974.
7. **Hydraulics**. Vol. 1, Athens, Georgia: University of Georgia, American Association for Vocational Instructional Materials.
8. **Operator's Manual -- 6600 and 7700 Combines**. Moline, Illinois: John Deere Service Publications, 1973.
9. **Owner's Manual -- 350 Hay Baler**. Birmingham, Michingan: Tractor and Implement Division, Ford Motor Company, 1959.
10. Parady, W. Harold. **Tractor Maintenance**. Athens, Georgia: University of Georgia, American Association for Vocational Instructional Materials, 1975.
11. **Repair Manual Ford Series 642 Combine**. The Ford Motor Company.
12. State of Florida Writing Team
13. Repair Manual. John Deere Combine

APPENDIX E

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STATE-OF-THE-ART LITERATURE

1. **Agricultural Mechanics**. Preliminary draft, Columbia, South Carolina: State Department of Education, Office of Vocational Education, Agricultural Education Section, 1974.

2. Bishop, Douglas D.; Amberson, Max L.; and Richardson, Barbara E. **A Study to Determine Competencies Needed by Employees Entering Agricultural Mechanics Occupations**. Bozeman, Montana: Montana State University. Department of Agricultural and Industrial Education, 1973.

3. **Course Outline for Agricultural Machinery-Service Occupations**. Columbus, Ohio: Ohio State University, Columbus Center for Vocational Education, 1965.

4. **Occupational Inventory-Farm Equipment Operator Occupations**. Blacksburg, Virginia: Division of Vocational and Technical Education, Virginia Polytechnic Institute and State University, Vocational-Technical Education Consortium of States, 1976.

5. **Fundamentals of Machine Operation**. Machine Operation Set, Moline, Illinois: John Deere Service Publications. 1973-1976.

6. **Fundamentals of Service. Power Mechanic Set**, Moline, Illinois: John Deere Service Publications, 1967-1974.

7. **Modules in Agricultural Education for Agricultural Mechanics**. Albany, New York: University of the State of New York, The State Education Department, Bureau of Occupational and Career Curriculum, 1974.

8. Phipps, Loyd J.; McColly, H. F.: Scranton, L. L. and Cook, G. C. **Farm Mechanics Text & Handbook**. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1959.

9. Smith, Harris Pearson and Wilkes, Lambert Henry. **Farm Machinery and Equipment**. New York, New York: McGraw-Hill, 1976.

10. Stone, Archie A. and Galvin, Harold E. **Machines for Power Farming**, 2nd edition, New York, New York; John Wiley & Sons, 1967.

11. Yoder, Edgar P. **Career Preparation in Agricultural Equipment and Mechanics: A Curriculum Guide for High School Vocational Agriculture**. Test edition. Columbus, Ohio: Ohio State University, Ohio Career Education and Curriculum Management Lab in Agricultural Education, 1974.

12. Yoder, Edgar P. and McCracken, J. David. **An Empirical Determination of Tasks Essential to Successful Performance as an Agricultural-Industrial Equipment Mechanic**. Columbus, Ohio: Department of Agriculture Education, Ohio State Univeristy Research Foundation, 1975.

13. Williams, Paul. **"Reporting Form Goals and Objectives--Agriculture Mechanics Program"**, Calhoun Area Vocational Center, Battle Creek, Michigan, n.d., (mimeographed).

APPENDIX F

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BIBLIOGRAPHY COMPILED BY THE SOUTH CAROLINA WRITING TEAM

Allis-Chalmers Model 70 Planter Service Manual. Allis-Chalmers Tractor Division Milwaukee, Wisconsin 53214

Automotive Electrical Systems, Classroom Manual. Chek-Chart, A Division of the H.M. Gousha Company, San Jose, California, 1978.

Christenson, Christina, Thomas W. Johnson, and John E Stinson. **Supervising**. Reading Mass., Addison-Wesley Publishing Co. 1982.

Compact Tractor Service Manual. Intertec Publishing Corporation, Kansas City, Missouri, 1975.

Cylinder Head Overhaul. (Filmstrip), Ford Trac-com, 1315 North Highway Drive, Fenton, Missouri 63026

Ford Tractor Repair Manual. Ford Motor Company, Ltd, Tractor Division, 14310 Hamilton, Highland Park, Michigan, 1967.

Fundamentals of Service . . . Belts and Chains. John Deere and Company, John Deere Service Department F, John Deere Road, Moline, Illinois 61265, 1968.

Fundamentals of Service . . . Engines. John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1968.

Fundamentals of Service . . . Engines. John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1977.

Fundamentals of Service . . . Hydrualics. John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1969.

Fundamentals of Service . . . Power Trains. John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1969.

Fundamentals of Service . . . Tires and Tracks. Third Editon, John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1977.

Generators. Delco-Remy, Division of General Motors Corporation, Anderson, Indiana.

George Jr.,Claude S. **Supervision in Action (The Art of Managing Others)**. Fourth Edition, Reston Va., Reston Publishing Co. 1985

Huffman, Harry, and Jeffrey R. Stewart, Jr. **General Recordkeeping**. Eighth Edition, New York, NY. Gregg Division, McGraw-Hill Publishing Co. 1981.

Hunt, Donnell. **Farm Power and Machinery Management**. Seventh Edition, Ames, Iowa: Iowa State University Press, 1979.

IH Blue Ribbon Service. (No. GSS 1398), International Harvester Company, Chicago, ILlinois

Implement and Tractor Shop Service. (No. F0-36), Technical Publications, Park, Kansas, 1979.

Implement and Tractor Service Manual. (No. IH-39), Intertec Publishing Corporation, 1014 Wyandotte Street, Kansas City, Missouri, 1976.

Industrial Hydraulics Manual. Speary Rand Corporation. 1401 Craus Road, Troy Michigan. 1970.

Jacobs, Clinton O. and William R. Harrell, **Agricultural Power and Machinery**. New York, N.Y. McGraw-Hill Book Company, Inc., 1983.

John Deere 14T Operator's Manual. John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1961.

John Deere Operator's Manual - 2750 Tractor. John Deere and Company, John Deere Service Department F., John Deere Road, Moline, Illinois 61265, 1982.

Light Utility Tractor Service Manual. Intertec Publishing Corporation, 1014 Wyandotte Street, Kansas City, Missouri 1975.

Massey-Ferguson 300 Combine Operator's Manual. (7500-10/65) Massey-Ferguson Company, DesMoines, Iowa 50315.

Mitchell Automechanics. Prentice Hall Publishing Company Inc. Englewood Cliffs, New Jersey, 1986.

New Holland 962 Corn Head Operator's Manual. (43096212), Sperry New Holland Corporation, New Holland, Pennsylvania 17557, 1976.

New Holland 962 Corn Head Operator's Manual. Sperry New Holland Corporation, New Holland, Pennsylvania 17557, 1986.

New Holland 479 Haybine Mower-Conditioner. Sperry New Holland Corporation, New Holland, Pennsylvania 17557, 1976.

Pease, Dudley A. **Basic Fluid Power**. Englewood Cliffs, N.J.: Prentice-Hall Publishing Company, Inc. 1967.

Phipps, Lloyd J. **Mechanics in Agriculture**. Second Edition, Danville, Ill.: The Interstate Printers and Publishers, Inc., 1977.

Phipps, Lloyd J. **Mechanics in Agriculture**. Danville, Ill.: The Interstate Printers and Publishers, Inc., 1983.

Service and Repair Instructions. Briggs and Stratton Corporation, Milwaukee, Wisconsin

Shulz, Erich J. **Diesel Mechanics**. New York, N.Y.: McGraw-Hill Book Company, Inc., 1977.

Toboldt, William K. and Larry Johnson. **Automotive Encyclopedia**. Seventh Edition, South Holland, Ill.: The Goodheart Wilcox Company, Inc., 1981.

Vermeer Operator's Manual. Vermeer Manufacturing Company, Pella, Iowa, 1972.